SCIENTIFIC AMERICAN

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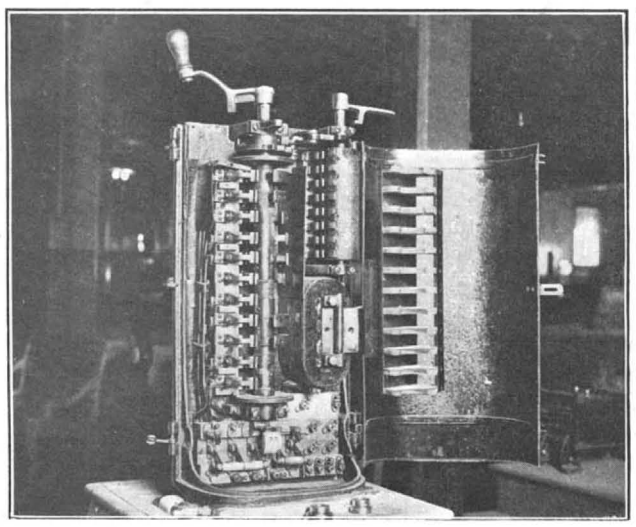

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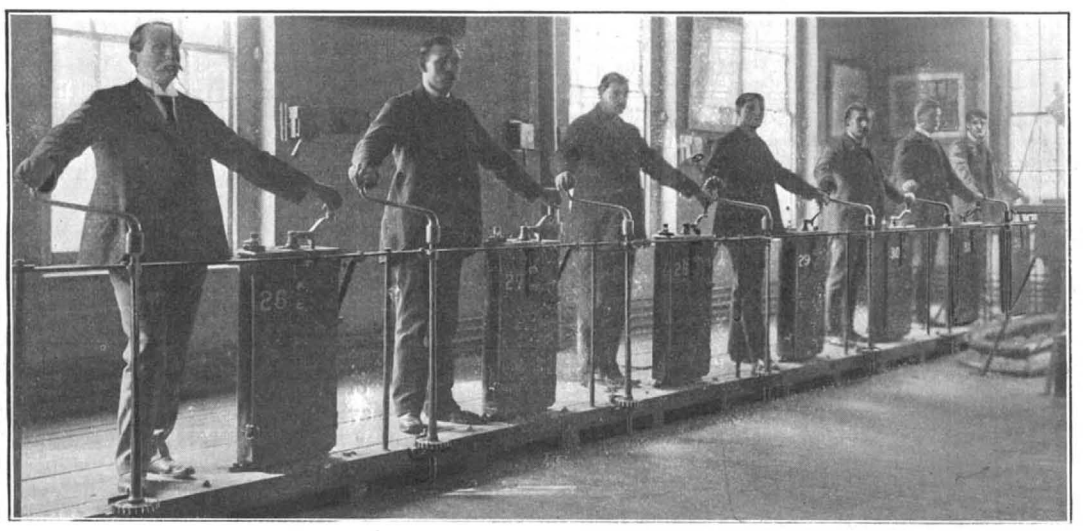

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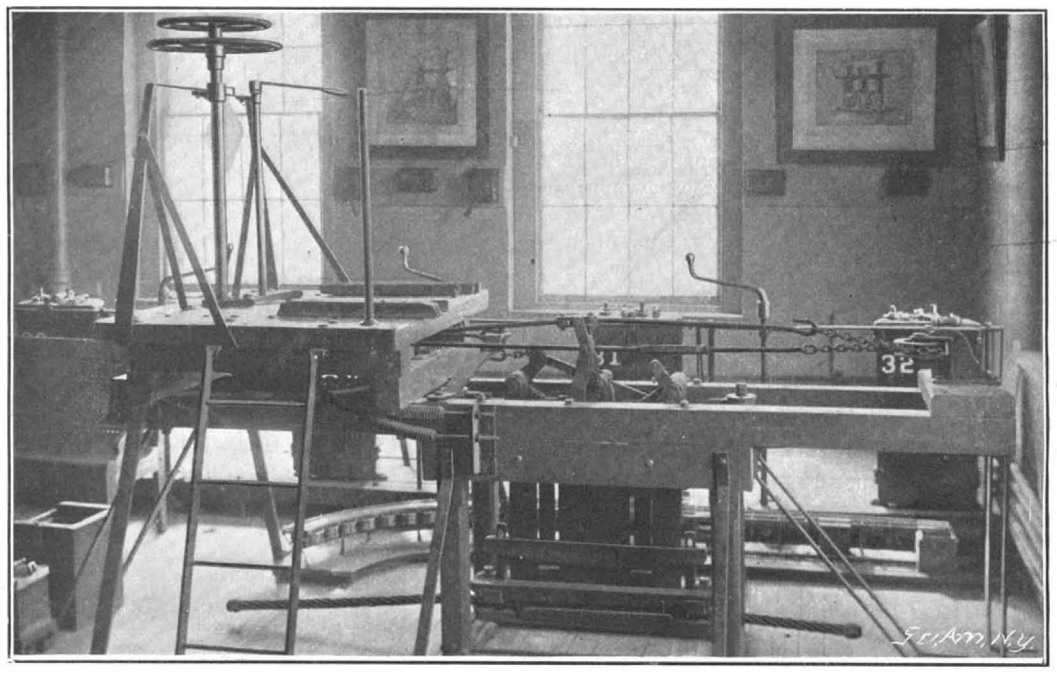
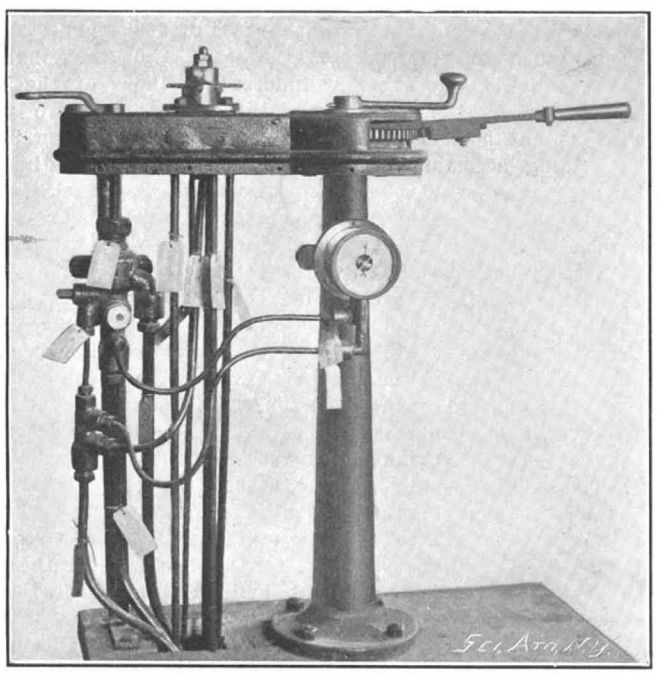
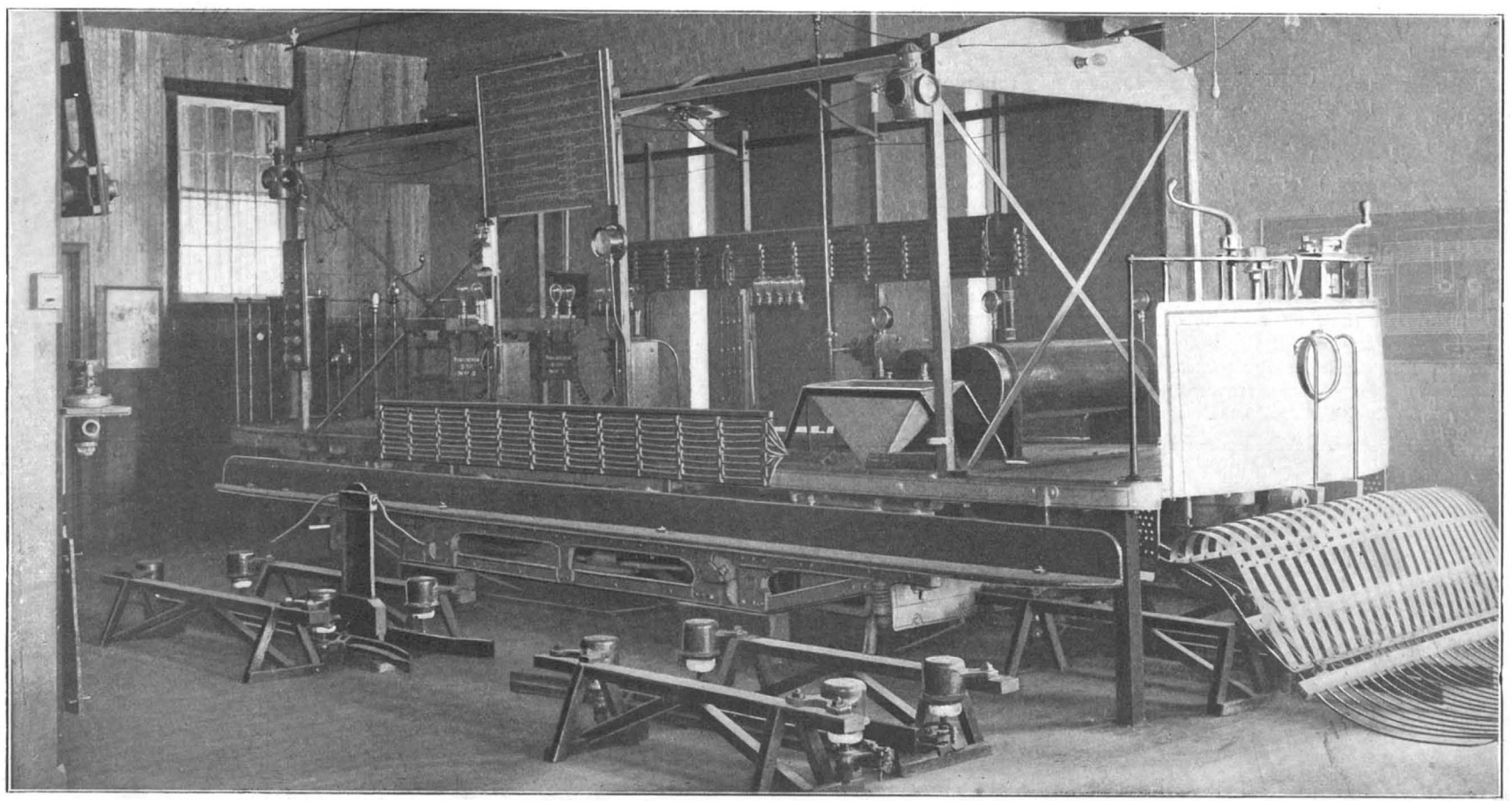


Cable-Car Grip.



Compressed-Air Car-Controlling Gear.



Electric Car and Section of Feeder Rails.

TRAINING SCHOOL FOR NEW YORK STREET-CAR MOTORMEN.—[See page 214.]

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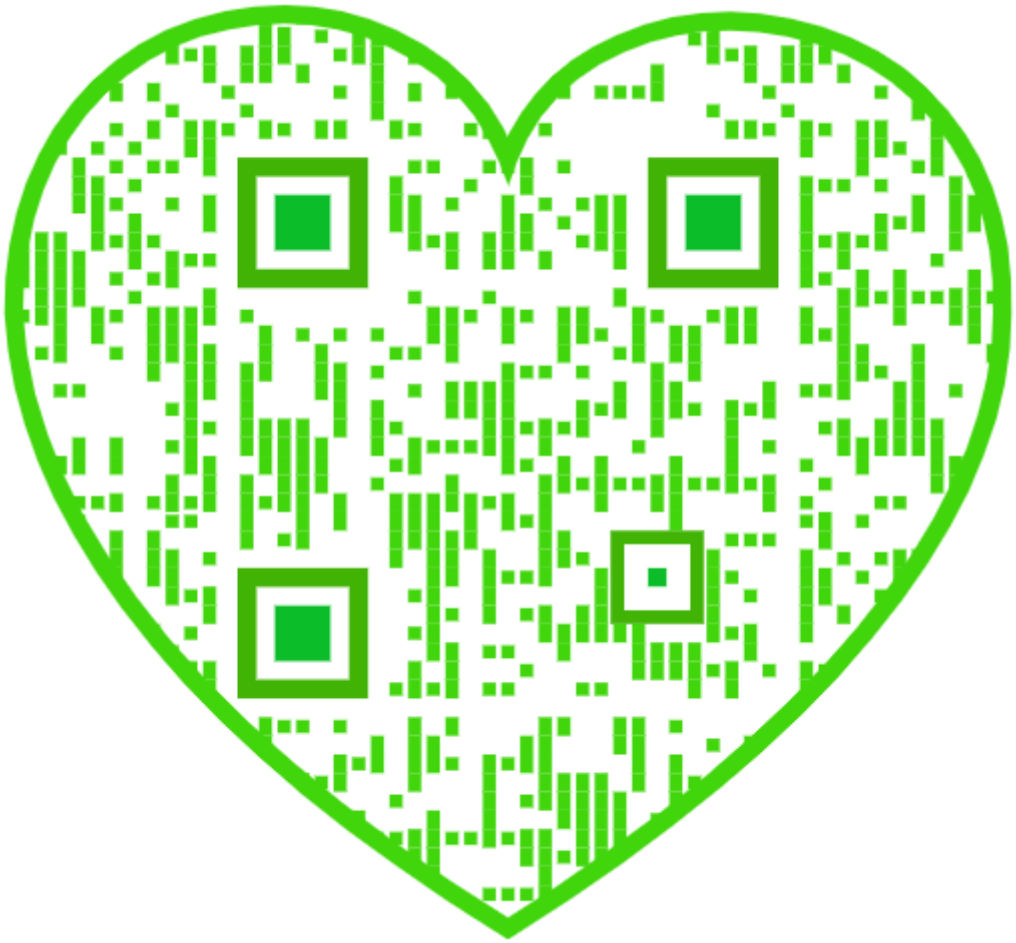

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NEW YORK, SATURDAY, APRIL 6, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PROSPECTS OF THE NEW ERIE CANAL.

In reply to a committee from the Commerce Convention in Syracuse, Governor Odell has expressed himself as being opposed to the policy of urging the Legislature to authorize the construction of the Erie Canal along the lines of the scheme which was strongly indorsed by his predecessor. As an alternative, the Governor is in favor of the completion of what is known as the project of 1895.

The canal, with the exception of such work as has been done in carrying out the 1895 scheme, is in the condition in which it was left after the enlargement of 1862. It has a depth of 7 feet, a bottom width of 52 feet and is capable of accommodating boats of 240 tons, with a capacity of 8,000 bushels of wheat. The plan of 1895, which is the one now indorsed by the Governor, provides for the deepening of the canal to 9 feet, with top and bottom widths of 73 and 49 feet, thereby providing accommodation for boats of 450 tons, with a capacity of 15,000 bushels of wheat. It provides for a single pneumatic, or some other form of single mechanical lift at Cohoes and Lockport, together with other changes at important points along the route of the canal. The estimated cost of this project is $2,161,645.

The alternative scheme, which was reported upon about twelve months ago by the Special Committee on Canals, calls for the enlargement of the canal to a depth of 12 feet, and a bottom width of 75 feet, with capacity for barges of 1,000 tons carrying 33,335 bushels of wheat. The scheme is estimated to cost $62,000,000; and it was drawn up on these ambitious lines because it was felt by the committee, in view of the recent completion of the Canadian system of canals with a minimum depth of 14 feet throughout, and in view of the strenuous effort which is being made to divert the Western wheat trade to Canadian ports, that the time had come to enlarge the Erie Canal sufficiently to enable it to compete successfully against its well-equipped rival. It was found that the 9-foot canal, while it was a decided improvement, as far as it went, would be altogether inadequate to meet the present emergency. The larger scheme, it was urged, would have a capacity of 20,000,000 tons per annum, and that the saving on that tonnage as compared with the present canal would be $12,200,000 per annum. The proposed canal could carry freight at a third of the cost by rail, and, as compared with the lowest rail-rate ever quoted, the saving across the State of New York, on a prospective tonnage of 20,000,000 tons, would be about $18,000,000 per annum.

After a careful study of the question, the Governor says he is satisfied that, on account of the strong opposition in some sections of the State against any further use of the State's money for canal purposes, it will be impossible to secure favorable legislation for the expenditure of the $62,000,000 required for the larger scheme. He is satisfied that the 9-foot canal would be regarded by the Legislature in the nature of a compromise, and that the necessary money for its construction could be secured.

We thoroughly agree with the Governor in his conviction that if anything is to be done in the way of improvement in the Erie Canal, it must be done at once, and that if the question should be allowed to lie dormant a few years longer, it might be impossible to secure appropriations of any kind for canal improvement. At the same time, we cannot but feel that if the citizens of this State, particularly those that live in what are known as the "granger counties," could be induced to look upon the question broadly, and not merely from the viewpoint of local interests, they would see that the construction of the 12-foot canal would promote the interests, not only of the terminal points at Buffalo and New York, but indirectly, by the multitudinous and far-reaching benefits which always accrue from a general increase of trade, the interests of the whole State. It is scarcely to the point that Governor Odell should draw a contrast between the crowded state of the canal docks in his boyhood's days and their comparatively deserted condition just now. In those days, not only was railroad competition less severe, but the canal, as such, was adequate in conveniences and methods to the necessities of the time; whereas to-day in its present condition, it is as much out of date as a system of one-horse street cars would be on the Broadway surface line in this city. With a 12-foot canal and 1,000-ton barges, the economic conditions of operation would be so vastly improved that we think the Governor would soon witness a return to the prosperous conditions of an earlier day.

WATER-TUBE BOILERS IN THE BRITISH NAVY.

At a time when our naval authorities are adopting the water-tube boiler, exclusively, for use in our new warships, the recent adverse report of the British Admiralty Committee against the use of the Belleville water-tube boiler cannot but excite great interest in this country. Indeed, the British navy is so vast, and its constructors and engineers have been in the main so successful in producing permanent types of vessels, that a reversal of their policy, involving the practical condemnation of the boiler power of the numerous and powerful ships that have been built during the past four or five years, has produced a pronounced sensation throughout the whole naval world.

The determination to adopt this boiler was made after a series of trials carried out in one of the gunboats of the navy, and the "Powerful" and "Terrible," cruisers of over 14,000 tons displacement and 22 knots speed, were the first important vessels in which it was placed. Following close upon the trials of these ships came the announcement that the Admiralty had decided to install the Belleville boiler in all future battleships and cruisers. The "Powerful" and "Terrible," however, had not been long in service before complaints began to be heard against the performance of the new boilers under daily service conditions. There were difficulties in maintaining the desired steam pressure, and they proved to be very extravagant in coal consumption. Although a consumption of fuel of about 1.8 pounds per indicated horse power per hour was given out as the result of a trial, it was found that the average consumption of the same ship, when cruising, was between 2.5 and 2.8 pounds per indicated horse power per hour. When we compare this with the consumption of 1.3 pounds, actually recorded last season on the fastest transatlantic steamer, and with the consumption of 0.97 pound recently achieved on a 400-mile trial of one of the freighters of the Inch Line of steamers, it can be seen that an adverse report from the Admiralty Committee was a foregone conclusion. We cannot do more than briefly summarize the more important findings of the committee, and must refer our readers to the current issue of the SUPPLEMENT for the full report.

In the first place, the committee are of the opinion that the advantages of the water-tube boiler, from the military point of view, are so great that, provided a satisfactory type can be found, it is preferable to the ordinary cylindrical type. They do not consider that the Belleville boiler has any such advantage over other types of water-tube boilers as to lead them to recommend it. The principal objections of the committee to this type are that the circulation of the water is defective; that an automatic feeding apparatus of a delicate and complicated kind is necessary; that a great excess of pressure is required in the feed pipes and pumps over the boiler pressure; that the water-gages do not reliably indicate the water-level; and that the up-keep of the Belleville boiler has so far proved to be more costly than that of the cylindrical boilers; while the additional evaporating plant required and the greater coal consumption on ordinary service as compared with cylindrical boilers, has hitherto nullified to a great extent, the saving of weight effected by its adoption. Lastly, the evidence before the committee showed that a large proportion of the coal expended in the navy is used to distill water and for other auxiliary purposes; and for such purposes the cylindrical boiler is considered to be more suitable and economical than any type of water-tube boiler. The report recommends that, as regards future ships that may be authorized, the Belleville boilers should not be fitted; as regards ships recently ordered, on which not much work has been done on the boilers, the boilers be not fitted; while the boilers are to be retained on completed ships and on those under construction, in which any alteration would delay completion.

While condemning this particular type, the committee is fully alive to the manifest military advantages of water-tube boilers as such; and they recommend an extended trial of four types of straight-tube boilers, which are now being adopted in foreign navies. These are the Babcock & Wilcox, the Niclausse, the Dürr, and the Yarrow large-tube boiler. It will thus be seen that a large section of the most recent ships of the British navy is equipped with a boiler which its own expert committee condemn, a fact which proves that in naval, as in many other matters, it is well to make haste slowly.

LONGITUDINAL FRAMING FOR THE HERRESHOFF CUP-YACHT.

Each of the two yachts that are being built for the defense of the "America" cup will present decided features of novelty among boats of their size and purpose. The Crowninshield yacht, as we pointed out in our issue of March 30, presents novelty of form, being for a 90-foot craft a wide departure from the Herreshoff model, and a purely original creation. The new Bristol boat, on the other hand, will adhere closely to the "Columbia" in form, but will differ radically from her in construction, her designer having broken away from traditional ideas—at least, in yacht construction—by substituting longitudinal framing for the transverse framing by which, from time immemorial, the boat-builder has given his craft the necessary strength. In the transverse system, as followed in "Independence," the form of the boat is preserved by 79 frames, spaced 21½ inches apart (not 2½ feet, as, by a typographical error, was stated in our last issue), and the longitudinal strength is afforded by tie-rod trussing in the overhangs, by side and bilge stringers, and by the natural resistance to distortion of the hull and deck plating, acting in a general way as a tubular girder. On this system, the transverse framing is the fundamental feature, and the longitudinal system is subsidiary to it. In the new Bristol boat, the main framing is longitudinal, and the transverse frames are worked in as subordinate and auxiliary. The result is a reduction in the total weight of material for a given strength. The idea is new in yachts, but not in naval architecture, Brunel having built the "Great Eastern" half a century ago on this system. It is stated that Herreshoff has reduced hull weights 25 per cent as compared with "Columbia." This is manifestly impossible; if he has saved from 7 to 10 per cent, he has done well.

OUR ADVANCING TRADE.

Although the recent increase in the exports of iron and steel manufactures from the United States has been simply phenomenal, there is at present no sign of falling off of the rate of increase. An analysis of the February export figures shows that for the eight months ending with February, 1901, the total export is six and a half millions greater than the truly phenomenal figure of last year, and nearly three times the total for the eight months ending with February, 1891, which means an increase of 10 per cent in a single year, and 333 per cent in the decade. In the eight months ending with February, 1901, iron and steel formed 3 per cent of the total domestic exports, whereas in the eight months just ended they formed 7 per cent. These total figures are particularly gratifying when it is known that the exports cover a great diversity of products, thus proving not only that our manufacturers are rapidly increasing their output, but that they are each year fabricating a large proportion of the product, and thereby securing for themselves and for the labor employed the greater share of the profits arising from such manufacture. Thus, ten years ago, such articles as typewriters, cash-registers, pumping machinery, electrical machinery, and other articles requiring a high degree of manufacture, had no place in the export schedules of the United States; whereas now they constitute an important part of our annual exportations of iron and steel, and are steadily increasing both in volume and in the number of foreign markets in which they find profitable sales. To take a single instance, we may quote electrical machinery, in which in 1891 no exports whatever were recorded; while in 1900 the figures for the transactions of two-thirds of the year had reached about $2,500,000. For a similar period in the present year they had risen to over $3,500,000. Another gratifying feature is the fact that the area of distribution steadily and rapidly enlarges. Exports which formerly went only to the principal countries of Europe are now shipped to China, Japan, Australasia, Africa, and the islands of the South Sea, where such articles as sewing machines and typewriters find a market in the most distant islands.

SYLVICULTURE AND THE SUEZ CANAL.

In an interesting article on the above topic, the Revue des Questions Scientifiques describes as follows the highly successful efforts of the Suez Canal Company to protect the banks and approaches of that great highway of the world's commerce by a systematic planting of trees and shrubs of various sorts.

The Suez Canal Company is utilizing to great advantage saplings, shrubs, and large trees in order to consolidate its banks, and to preserve the maritime canal from the encroachments of the desert. The operation began in 1897, and was continued from year to year with the improvements suggested by experience.

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For the purpose of diminishing the effects of erosion at the edge of the banks of the maritime canal, and of the swells caused by the passage of vessels, there has been planted at the water's edge a reed of unusual dimensions, the Arundo gigantea, which speads its roots rapidly in the water and quickly attains a height of from ten to twenty feet. Farther back, on the slopes of the banks, there is employed with success several varieties of tamarisks (T. gallica, T. nilotica, T. articulata), whose branches take root when the sand hills just cover them, and which are intermingled with herbaceous plants like the orach (Atriplex halium) and the alfa (Stipa tenax).

In addition to the foregoing precautions it was necessary to protect the canals from the encroachment of the desert sands driven by the wind. To accomplish this there has been established, at about 350 feet from the water's edge, hedges formed of arborescent species, and 170 feet long. The filao, with horsetail leaves (Casuarina equisitifolia), an Australian tree quite well naturalized in Egypt, the acacia of the Nile (A. nilotica), the eucalyptus globulus et robusta; the cypress of Lambert; the caoutchouc and Bengal fig trees (Ficus elastica, F. bengalensis); poplars, mulberry trees and even the sycamore generally thrive well on these plantations, especially in silicious soils; this, however, is due to artificial irrigation obtained by cutting ditches from the fresh water canals derived from the Nile for the sustenance of the inhabitants.

Vegetation is more rebellious where the soil is found to be argillaceous, compact or too solid. In order to overcome this the lime-bearing waters of the Nile have been brought down, after much labor, and now a number of tamarisks, willows, orachs and other trees thrive well.

On the banks where the swells of passing vessels would endanger the young plantations of reeds, they are sheltered, for the first few years, by hurdles which are taken elsewhere when the plants thus protected have acquired sufficient strength.

THE HEAVENS IN APRIL.

BY HENRY NORRIS RUSSELL, PH D.

Although Mars is now some time past opposition and more than eighty million miles distant, he is still the most interesting object in our evening skies; and this not so much for what we know about him, as what we imagine.

The belief in his habitability, rather strengthened than diminished by the discoveries of recent years, but as yet incapable of proof or disproof, finds its most appealing presentation to the public mind in the idea of possible signaling between men and the inhabitants of the planet.

Let us for the present assume that such intelligent inhabitants exist, and that the Martian canals are their work. We may then go on to consider what signaling to them involves, and whether it would be mechanically possible.

At the outset we are limited to two ways of signaling—by means of light, and by the electric waves of the same nature but enormously longer period used in wireless telegraphy, since these alone, of all earthly means of communication, can pass through interplanetary space. Of these two, light is by far the most promising, as the unaided eye can detect a far smaller amount of energy in that form than the most delicate instruments can in the form of electric waves.

When Mars is nearest us, the earth is almost directly between him and the sun. In consequence we can only see Mars at night, and his sunlit side is turned toward us. From Mars, on the contrary, only the dark side of the earth can be seen, and that in the Martian daytime. Therefore signals from the earth to Mars would have to be made by artificial light, while those in the reverse direction might be made with reflected sunshine. Moreover, our signals would be obscured by the glare of the Martian sky close to the sun; while theirs would have only the light of the planet and stars to interfere with them. For both these reasons it is much easier for the Martians to signal to us than for us to reply, and therefore we will first calculate on the supposition that they are flashing to us with reflected sunlight.

It is surprising how small a mirror will suffice to produce signals visible at a considerable distance in broad daylight. One three inches in diameter gives flashes which are conspicuous to the naked eye ten miles away. Indeed, this is the system of heliographing messages of which we have heard so much from South Africa. The writer has no available data as to the minimum size of mirror which can be used. It is, however, probably safe to allow an inch of diameter of the mirror for each ten miles of distance if the signals are to be clearly read by the naked eye, and we will use this ratio in our work.

In the case of Mars the signals would be observed with large telescopes transmitting perhaps 10,000 times as much light as enters the naked eye from the same object. In consequence the Martians' mirror need have only 1-10,000 of the area or 1-100 of the diameter that our heliograph rule would require. We need make no extra allowance for the fact that the Martian signals are to be observed at night, since they would be seen against the bright background of the planet's disk, just as the terrestrial flashes are seen against sunlit sky or hills.

Our final ratio is then one inch of mirror diameter for each thousand miles of distance. Now the least possible distance of Mars is 35,000,000 miles. The mirror with which its inhabitants signaled to us would therefore have to be at least 35,000 inches or nearly 3,000 feet in diameter. To produce such a piece of glass is clearly far beyond the present resources of human engineering. It seems possible, however, that beings who could construct the Martian canals could also make such a mirror, but once made its mounting would present still greater trouble. It would have to be set up so that its plane was equally inclined to the directions of the earth and sun, and moved by some sort of gigantic clockwork, to counteract the planet's rotation just as telescopes have to be moved on earth. To make flashes by covering up the whole enormous structure, or by tilting it, seems hardly possible; but this end could be attained by a mirror composed of parallel strips, like the slats of a window blind, which could all be turned out of their plane at once, and later brought back to place by relatively simple mechanism; the whole to be mounted in a great frame moved by the clockwork spoken of above. No firm on earth would take the contract for such an apparatus; but it does not seem impossible that the human engineering of a few centuries hence might be equal to the task. So we reach the interesting conclusion that it is not inconceivable that men residing on Mars might be able to heliograph messages to us; and we cannot deny the same ability to the Martians, however unlike us they may be.

How hopeless the task of signaling to them would be we can now see. What gigantic conflagration, what combination of all the searchlights of the world, could produce a ray equal in intensity to a solid beam of sunlight a thousand yards across? How could we point them all correctly? And how interrupt their light at will? Remembering that these are the conditions for sending a message from Mars and that it is much more difficult to signal in the reverse direction, we may give up once for all the idea of any regular communication between the two planets.

THE HEAVENS.

As we once more watch the heavens at 9 o'clock on the evenings of the middle of the month, we see that we must soon bid good-bye to many of our old friends among the stars.

Canis Major, Orion, Taurus, and Perseus are all close to the horizon, and before another month has passed we shall lose them all. Cassiopeia, in the far north, escapes a similar fate only because her diurnal circle about the pole does not quite dip below our horizon. Auriga, Gemini, and Canis Minor are higher in the western sky, and we shall not lose them for some time yet.

Ursa Major and Leo are at their highest, fairly on the meridian. Lower down on the east is Virgo, with the brilliant Spica, and the arc of fairly bright stars between it and Leo. Below this is the little but conspicuous quadrilateral of Corvus, the Crow, who is perched on the back of Hydra, whose whole length can now be seen stretching from Canis Minor to Libra.

Arcturus is well up in the east, and Vega has just risen. Between them are the graceful circlet of Corona Borealis, and the extensive constellation Hercules, and below are parts of Ophiuchus and Serpius.

THE PLANETS.

Mercury is morning star all the month. His greatest elongation occurs on the 3d, when he is unusually far from the sun, but as he is also south of him, he rises only about an hour before sunrise.

Venus is morning star till the last day of the month, when she passes through inferior conjunction and resumes the rôle of evening star. She is too close to the sun throughout the month to be well seen.

Mars is still in Leo, moving westward till the 4th, then slowly eastward. He comes to the meridian about 8 P. M., and does not set till nearly three in the morning.

Jupiter is in quadrature with the sun on the first; that is, he is 90 degrees west of him and on the meridian at 6 A. M. Saturn comes to a similar position on the 5th. The two planets are getting quite close together in the constellation Sagittarius and will remain so for some months.

Uranus is farther west, in Scorpio, and rises about 11 P. M. on the 15th. Neptune is in Taurus, nearly opposite the planet last named.

THE MOON.

Full moon occurs on the evening of the 3d, last quarter on that of the 11th, new moon on the afternoon of the 18th, and first quarter on the forenoon of the 25th. The moon is nearest the earth on the 18th, and most remote on the 4th.

She is in conjunction with Uranus on the night of the 8th, Saturn on the morning of the 11th, and Jupiter on the afternoon of the same day; with Mercury on the morning of the 17th, Venus on the afternoon of the 18th, Neptune on that of the 23d, and Mars on the morning of the 27th.

AUTOMOBILES IN NEW YORK.

The above was the title of an address by G. Herbert Condict, before the New York Electrical Society, on March 27, at the new station of the Electric Vehicle Transportation Company, corner of Forty-ninth Street and Eighth Avenue, in this city. Before a very large audience, standing in an electric runabout for a platform, Mr. Condict related briefly a few facts concerning the rise and growth of electric transportation. He remarked that there were at the present time four hundred and fifty automobile vehicles in New York, as compared with about four thousand horse-drawn. In the next twenty years it was a possibility that no horse-drawn vehicles would be permitted in the streets, and so the vast expense of keeping the latter clean would be saved.

It was during seasons of snow and ice, when the smooth pavements were slippery, that the demand for electric vehicles was the greatest, and frequently overtaxed the facilities of the company. At these times, on one occasion, as many as four hundred calls an hour had been received. The company, of which Mr. Condict is the chief engineer, decided in the spring of 1900 to secure larger quarters, and began the work in August of last year of transforming half of the great building on Eighth Avenue, between Forty-ninth and Fiftieth Streets, formerly used as the Eighth Avenue car stables, where over 1,500 horses were accommodated, into an enlarged station covering three acres, equipped with motor current transformers, which take the Edison alternating current at 3,200 volts and deliver direct current at 110 volts; a special switchboard, which controls the current supply to six hundred separate sets of batteries, with room to spare for controlling one thousand batteries at a time; electric motor automatic water pumps for supplying the roof tank which produces the hydraulic pressure for elevating the sets of batteries and transferring them to and from the vehicles; an immense battery room, ventilated by two large electrically-operated fans in the roof; two great electrically-propelled cranes spanning the room, arranged with separate motors, for lifting and lowering individual sets of batteries from or to the charging fingers on the floor; a battery repair room, a well-equipped machine shop on an upper floor, a motor room for repairing and adjusting motors and parts to vehicles, a blacksmith shop, a paint shop, and adjoining the machine shop a long room having a double trolley wire overhead, on which runs a trolley carriage, and from it the current is conveyed by a flexible wire to a cab for testing the motors and the running of the vehicle without a battery.

When a vehicle comes in for the day the battery is transferred to the charging room, and the vehicle is washed and sent up stairs. There it is carefully inspected, the rubbed plate battery connections are brightened with sandpaper, the motors are cleaned, the vehicle trimmings examined, and the tires blown up. It is then ready for the next day's business.

So complete are all the arrangements that it was stated within fifteen seconds of the receipt of a telephone call a cab is started on the way to answer it.

The station and the system is regarded as the largest in the world, and is the most unique and perfect in all its appointments for the rapid handling of individual batteries and inserting and withdrawing them from vehicles. It represents the possibilities of the practical use and application of electricity on a large scale as applied to transportation. This system was illustrated in the SCIENTIFIC AMERICAN, March 25, 1899.

METHOD OF DETECTING HYPO IN PHOTOGRAPHIC WORK.

The importance of thoroughly eliminating the hypo from negatives or prints in photographic work is so well recognized that it need not be insisted upon, and it will therefore be useful to give a method which has been brought out in the Belgian Photographic Bulletin for detecting small traces of hypo in the washing water and thus observing when the operation is finished. Into a deep tray is poured a small quantity of the water or solution in question and a few pieces of granulated zinc are thrown in, after which add a few drops of hydrochloric acid. Place above the tray a filter paper wet with a solution of acetate of lead. If the least trace of hyposulphite remains in the solution the paper will become brown, and afterward assume a black metallic appearance. This action is due to the formation of hydrogen sulphide, which escapes to the surface and colors the paper by forming lead sulphide. In this way it is always easy to determine when the washing is finished or to examine a solution suspected of containing hypo.

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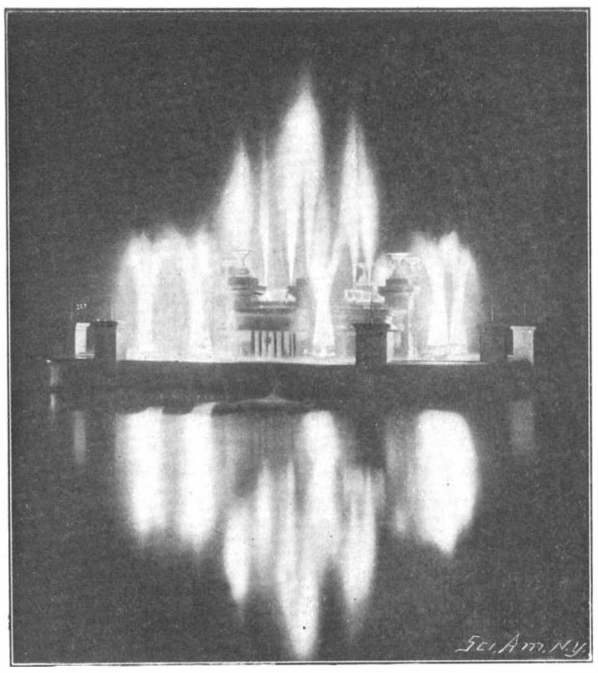
ELECTRICALLY ILLUMINATED FOUNTAINS.

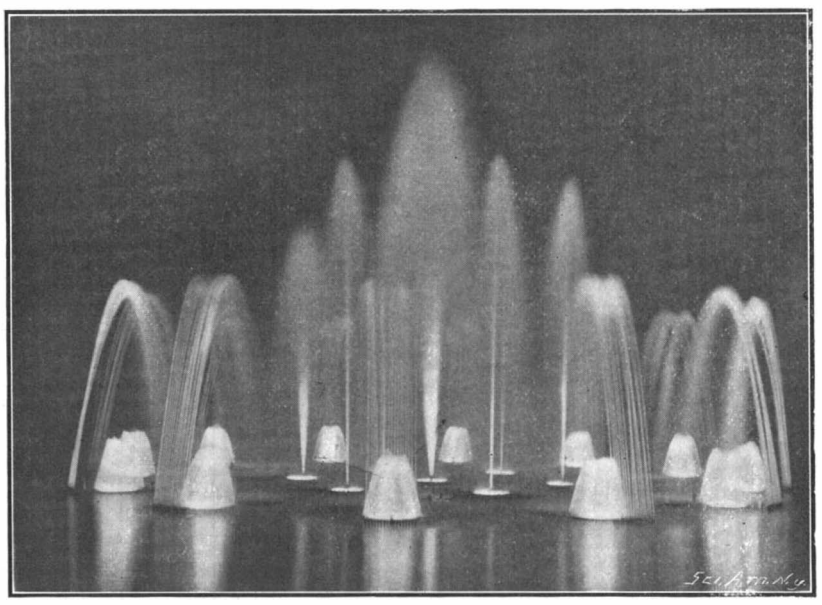
Of late years the electric illumination of fountains has been carried to such a point that the best of them form a spectacular display, which will continue for two hours before the series of designs which can be formed is exhausted. A fountain was recently erected in Philadelphia, which shows over fifty different designs illuminated in various colors by the system of illumination employed. As an amusement feature, these displays have proved very attractive, and city authorities as well as owners of private parks have gone to considerable expense in securing them. In Prospect Park, Brooklyn, a fountain is in operation, which cost $25,000.

In planning the electric fountains, the basin to contain the water is constructed of stone or concrete in the usual manner, except that portions of the bottom are covered with glass. The electrical apparatus is usually located in a chamber beneath it. The chamber is connected with the surface by an underground passage, which is also used as a conduit for the electric cables. The wires of the cables connect with a stand, or switchboard, containing a series of electric buttons, and extend to lamps of both the arc and incandescent type, placed in the various pipes or funnels, through which the water is forced. The lamps are protected from the water by panes of colored or clear glass, some of them being covered with a set of movable panes which can be swung or whirled by the use of compressed air. Arc lights are utilized for the general illumination, and their rays are intensified by movable reflectors, so that beams can be thrown upon the upper or lower part of the water and at any angle desired. The buttons are colored to represent the tint desired in the illumination. For instance, the operator presses a red button when he wishes to introduce light through the red glass, a yellow button when it is desired to give a yellowish hue, and a green button when it is desired to give a green tint, etc. The designs in water are created by the shapes of the pipes through which it is thrown into the air, and by the arrangement of the holes in them. A conduit supplying a one-inch stream may have its nozzle pierced with holes in the shape of a star, an umbrella, or open to form a single jet, as desired. If its stream is to be thrown vertically into the air the pipe is, of course, placed in a vertical position. If it is to form an angle, the position is varied accordingly. As the larger fountains may have several hundred pipes arranged in various positions in the basin, an idea can be gained of the combinations. The water is conducted from the reservoir or pumping station to the fountain by underground conduits in the usual manner. Valves are set in the conduits and in the smaller pipes, and are connected with the operating chamber in such a manner that each is controlled merely by the pull of a lever. The set of levers is arranged somewhat similar to the apparatus in a railroad block signal station. In planning the display, the piping and wiring are, of course, installed to allow the use of single jets and combinations, and the introduction of colored illumination, as desired. This must all be arranged in advance, as the pipes and wire cables are generally inclosed in concrete, or other waterproof material, after being connected with the various funnels and jets beneath the basin.

Such is the simplicity of operation that only two men are required—one to work the levers, and the other the buttons. A small window of thick glass allows them to note the water formation from their stand in the underground chamber. When the time for the display arrives, the electrician takes his place at the switchboard, and gives his orders to his assistant. The latter pulls the lever he indicates. As soon as the column of water appears, the electrician illuminates it by pressing a button on the switchboard. If it is a single jet, it is allowed to play for two or three minutes; then several others are added by another pull of the lever. It remains illuminated by the white light until the electrician presses another button and the tint is changed. Different effects are produced in the same manner. As already stated, the combinations which can be arranged are really remarkable in their extent. The Brooklyn and Philadelphia fountains, which were designed by Mr. F. W. Darlington, of Philadelphia, display umbrellas, various flowers, sheaves of wheat, globes of liquid, and spiral columns which writhe in the air like snakes. At Willow Grove Park, Philadelphia, the arrangement is such that a cascade can be formed in the shape of a fan extended. This constitutes a background, or curtain, on which colored pictures are thrown by means of a stereopticon, giving a novel, yet beautiful, effect.

The quantity of water required varies from a few thousand gallons an hour to as high as 100,000 gallons in the larger fountains. A pressure of from 125 to 150 pounds to the inch is required for the more elaborate displays, and usually the supply is forced to the fountain by a powerful steam or electric pump. There is no necessity for waste, as the water can be forced back to the pumping station or reservoir and used over and over if desired. An electric current of 500 volts is usually sufficient for the illumination. For the larger fountains it is sometimes generated in an individual station, but when they are set up in pleasure grounds owned by street railway companies, or in cities where the municipal authorities have their own electric light plant, the current can be carried from the central station by means of the cable system.





ELECTRIC FOUNTAIN EFFECTS.

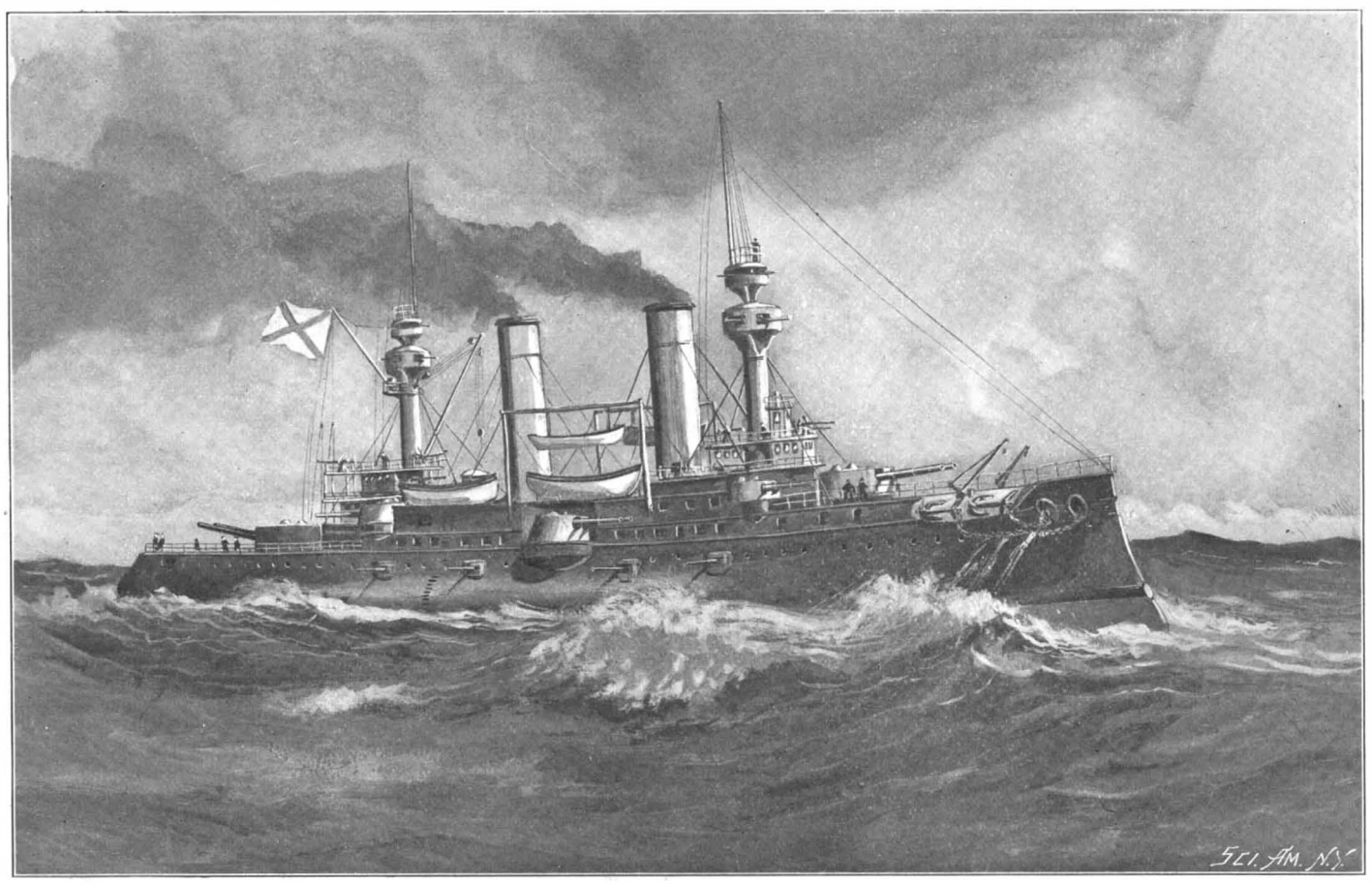
THE NEW RUSSIAN BATTLESHIP "CZAREVITCH" AS SHE WILL APPEAR WHEN COMPLETED FOR SEA.

The sudden effort at expansion in which the Russian navy is just now engaged has led to orders for the building of new battleships and cruisers being distributed in a large number of different places and countries. Like America, France has come in for her share in this business, and one of the most important warships now under construction for the Russian navy in that country is the "Czarevitch," which is being built at the well-known yard at La Seyne, near Toulon, belonging to the Forges et Chantiers de la Mediterranée.

This ship, when complete, will be a big armor-clad of 13,000 tons displacement, bids fair to be a very formidable ship of war, and has that somewhat "ferocious" appearance for which French battleships are conspicuous. Her masts, heavy, castelated, and bristling with guns; her tumble-home sides; her high superstructure and numerous "tourelles," or turrets, all contribute to impress the onlooker with the idea of war-like power. This appearance, like others, is, however, not infrequently somewhat deceptive, but in the present case cannot be considered so, as both in offensive and defensive equipment the "Czarevitch" is extremely well provided.

Her armament consists of four 12-inch guns, twelve 5.9-inch rapid-firing guns, twenty 12-pounders, twenty-pounders, six 1-pounders, and a couple of 2-pounders, or sixty-four guns in all, equaling the number carried in the old sailing battleships of the early part of the century. Her defensive armor is of considerable area. In the first place, she has a complete belt of armor having a maximum thickness of 9 inches, and upper and lower armored decks, while all her heavier guns are placed in barbette turrets, the heavier of which, containing the four guns forming her principal armament, are 11 inches thick in the turrets, and 10 inches in the barbettes. The hoods of the six turrets containing the twelve rapid-firers of her secondary armament are 6 inches in thickness on barbettes of 5-inch plating.

The "Czarevitch" is provided with



NEW RUSSIAN BATTLESHIP "CZAREVITCH."

Displacement, 13,000 tons. **Speed,** 18 knots. **Armor:** Belt, 9 inches; gun positions, 10 and 11 inches for main battery, 5 and 6 inches for secondary battery. **Armament:** Four 12-inch; twelve 6-inch rapid-fire guns; twenty 3-inch; twenty 3-pounders and 8 smaller guns. **Torpedo Tubes,** six. **Complement,** 700. **Date,** 1901.

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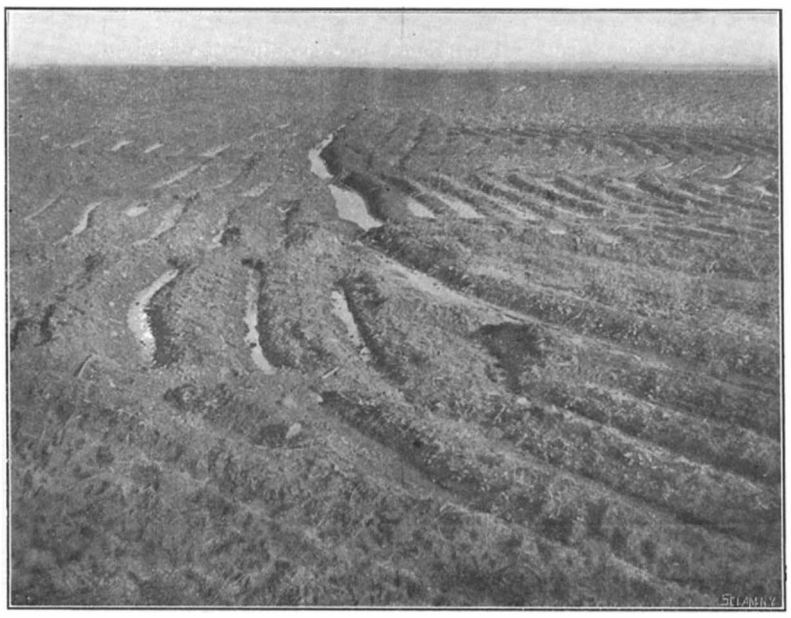
six torpedo-tubes, of which two are below water, the remainder being situated at bow, stern, and on either broadside. The new battleship will be a twin-screw vessel, and is estimated to attain a speed of 18 knots an hour. Belleville boilers, twenty in number, are to be fitted, and will supply steam for two sets of four-cylinder triple-expansion engines, working up to 16,300 horse power. The "Czarevitch" will be fitted with six electric projectors and a complete installation of electric lighting. Electricity, too, will supply the motive power for revolving the turrets and other purposes for which local machinery is required. She is to be fitted as a flagship, and will carry a crew of 700 men.

A SUGAR CANE REAPER WANTED IN HAWAII.

The Hawaiian Sugar Planters' Association have a most important problem to solve, namely, the invention and designing of a reaper for sugar cane in plantation fields. They have set about the problem in an eminently practical manner, offering prizes which aggregate $8,500. A prize—or reward, as the Association terms it—of $2,000 is offered for the best practical design of a machine for reaping the cane. This competition will close on the 30th of June, 1901. The design selected is to become the property of the Association, who may cause the machine to be manufactured for actual trial. A further prize, or reward, of $5,000 is offered for the best working machine that will actually reap cane in the field in a practical manner. This part of the competition will close on December 31, 1901. Should the machine built from the accepted design participate in the actual trials and be successful, the inventor will receive $3,000 in addition to the $2,000 which he has already received in the first part of the competition. If the competition is won by a machine not manufactured by the Association, it will be purchased from the inventor by the Association at the cost price delivered in Honolulu. A further prize of $1,500 is offered for the best design of an apparatus to transport the cane to and load it in railway cars. This competition closes on the 30th of June, 1901. Competitors are required to submit drawings of the machine as a whole, together with full detail-drawings, and only a description where the design is called for. In the second part of the competition, where a machine is called for, competitors will be required to furnish the machines to be experimented with in the field by the board of judges. Should the Hawaiian Sugar Planters' Association accept a design of machine, the payment of the reward will be equivalent to the purchase of all patent rights to such design or machine in the Hawaiian Islands. All communications should be addressed to the secretary of the Association at Honolulu. In order to enable inventors to gain some idea of the practical nature of this problem, we have secured some photographs taken specially to show the conditions which prevail in sugar cane plantations in the islands. The photographs are taken on an irrigated estate, and the figures may be considered as the average.

The canes grow in furrows, 30 feet long and 5 feet apart, center to center. They follow the land contour, and for this reason are sometimes straight and very often curved. At the end of each 30-foot furrow is a water-course 18 inches wide, which supplies one set of furrows. These water-courses are from 50 feet to several hundred feet in length, depending upon the contour of the land. They draw their supply of water from what are termed "level ditches," so called because of their very slight flow. They are from 4 to 5 feet wide and 1½ feet deep, and run through the fields at convenient distances to supply the water-courses. For the operation of any reaper these ditches would be temporarily bridged.

From the furrow-bottoms the canes emerge irregularly. They range in number from 100 to 160 canes per 30-foot furrow, and when ripe are from 14 feet to 20 feet long, with an average stalk diameter of 1.60 inches. The weight of cut cane runs from 70 tons to 105 tons per acre, with an average of 86 tons. They contain 11 per cent to 12 per cent of fiber.



SUGAR CANE FIELD JUST PLANTED, SHOWING FURROWS AND WATERCOURSES.

CANE CUTTERS AT WORK ALONG LINE CUT OUT FOR TRACK.

The canes do not stand upright. Owing to their own weight, they lie along the ground for three-fourths of their length, with a perpendicular upturn for the remaining fourth, surmounted by the green leaves, or "top." After emerging from the soil, they reach out in all directions, forming a sort of mat of interlacing canes below these fairly upright tops. It will, therefore, be noticed that, with furrows 5 feet apart, the canes of above lengths will lie across two furrows, provided their growth be in that direction. The top to be removed consists of a portion of soft cane low in saccharine matter, of green leaves attached at their bases to the stalk, and of unformed leaves in process of growth. Any reaper must of necessity cut canes off where they emerge from the soil and cut off tops in a satisfactory manner.

Concerning the loading device, the illustrations show the condition of the canes. The canes when cut are laid upon the field on top of the loose leaves and tops. This mat of leaves is several inches thick. Canes are cut in lengths about 5 feet long. As far as possible, they are laid straight; owing, however, to the curving of cane stalks, they are frequently laid irregularly. Portable tracks are placed in the fields, running generally parallel to one another, from 150 to 250 feet apart. Cars are run on these tracks in trains of about forty in number, and placed to suit. The car bottom is 2 feet from the ground; its length is 11 feet, and breadth 6 feet. It is assumed that canes on the ground will have to be placed on the conveyer of loader by hand. Any machine for cutting or loading should be operated by either horse power, gasoline, or electricity. Any engine deriving its power from coal or wood, which would either drop cinders or throw sparks, cannot be used in a cane field.

The quantity of cane loaded per day at this particular plantation averages 1,150 tons. For season of 1902 this will be doubled. From this it will be gathered that competitors should design substantial machines, capable of handling cane in large quantities.

It is hoped that American inventors will not be backward in devising an acceptable reaper and loader. We already lead the world in agricultural machinery, and we shall probably continue to do so.

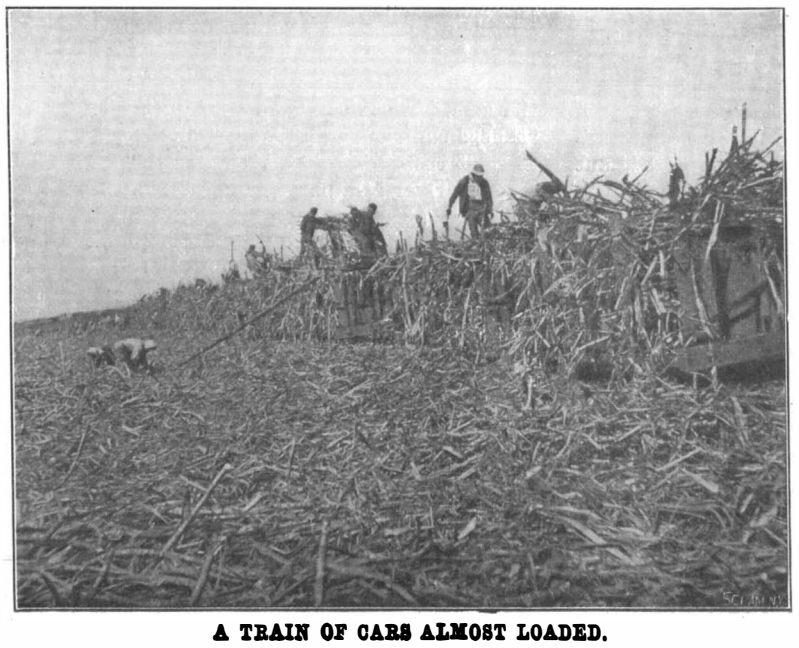
The Becquerel Rays.

A new technical journal, Kirchhoff's Technische Blätter, to be issued within a few days, will contain an interesting article concerning the latest rays.

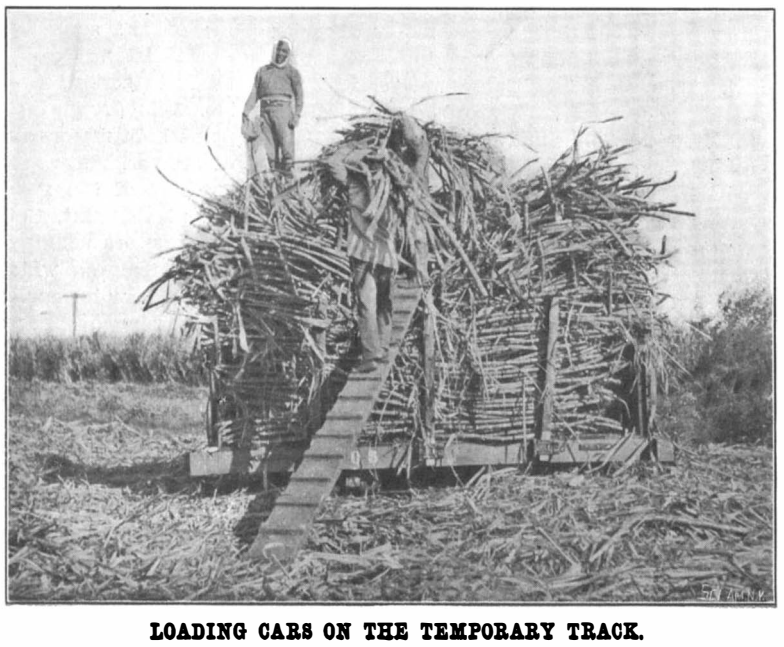
In 1895, a French chemist discovered rays emanating from the element uranium, which possessed properties similar to the Roentgen rays. They were called Becquerel rays, after their discoverer. But while the discovery of Roentgen aroused great interest in the whole civilized world, leading to radical changes in medical diagnosis, the Becquerel rays were only employed in a very limited way in physical laboratories, and an assertion by the French scientist, Demarcays, that they were not emitted from uranium, but from a new element, made no impression.

Recent experiments by the Berlin High School of Technology have proven this assertion—that a new element is responsible for the Becquerel rays—and the interesting fact has been observed that these rays render almost every transparent substance luminous in the darkness.

These rays make it possible to tell genuine diamonds from artificial ones in the dark. This will prove of great practical importance in testing. The experiments have also resulted in obtaining, for the first time, larger quantities of the new element, which has demonstrated that rays emanating from a larger quantity make the air such a conductor of electricity that it is hoped this property can be utilized in wireless telegraphy. Experiments for this purpose are being made in the Berlin institution, but the deepest secrecy



A TRAIN OF CARS ALMOST LOADED.



LOADING CARS ON THE TEMPORARY TRACK.

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is maintained concerning them. It is stated that the results will soon be laid before the Emperor, which seems to indicate that the discovery is regarded as one of great importance.

TRAINING SCHOOL FOR NEW YORK STREET-CAR MOTORMEN.

To the man in the street, the running of a 38-foot electric car of the underground conduit system, at a fairly high rate of speed, through the most crowded and busy streets of the world, is a matter which involves merely the turning of a controller-handle and of a brake-lever in obedience to the signals given by the conductor. But the man on the car is chosen, not because his work is apparently so simple, but because he has proved his fitness to hold his position by an arduous preliminary training. The heavy cars of our large cities cannot be controlled unless the starting apparatus be properly manipulated, unless the brakes are operated in a certain way, and cannot be safely driven through an interminable stream of wagons unless the motormen have no inconsiderable presence of mind and reasonably good judgment.

In order to train its men to think and act with coolness and precision, the Metropolitan Street Railway Company established a training-school some two years ago, in which ambitious recruits were to be systematically taught how to become not only acceptable motormen, but also fairly good electricians, thoroughly familiar with the mechanical and electrical construction of an electric car. The school was the first of its kind ever founded. When it was started by President Vreeland it was scoffed at; but the best proof of its success is to be found in the fact that the street railway-companies of the largest cities have followed the example of the New York company.

Before he is admitted to this training-school, the applicant is examined by a physician. If his eyes be weak, or if he be not sufficiently robust, he never even sees the training-school. The applicant who has successfully passed the physical examination is admitted to the school, and is assigned to one of thirty dummy car-platforms, disposed around the classroom, each fitted with a controller, a brake, a ground-switch, and a fuse-box. He is given a book of rules—his electric-car gospel—which he must learn as thoroughly as he once learned his forgotten catechism and the Ten Commandments. The breaking of one of these rules is a sin for which almost any punishment may be meted out. But, of all offenses, the most heinous is the neglect to remove the handles of the controller upon leaving the car. "Never leave the car-platform for an instant without removing the handles of the controller," is so thoroughly and persistently dinned into the embryo motorman's ears that the rule is followed in the end almost instinctively. Even the men who are tolerated in the school merely because they will not be convinced of their unfitness, never leave the dummy-platform with the controller-handles in place, although as a ruse they may be called by the instructor to his desk to receive some paltry information.

During the few days passed on the dummy platform, the motorman is taught how to start his imaginary car without hurling the passengers from their seats, and how to stop gradually under ordinary circumstances, and suddenly in a case of emergency. The advisability of turning the controller-handle one contact-point at a time, so that the power is applied gradually, is forcibly impressed upon him. In order that he may obey the signals of the conductor, the schoolmaster conveys his orders largely by means of an ordinary car-bell.

When he has learnt the rudiments of his calling, the pupil is taught something of the mysteries of electricity. He is taken to the classroom controller, the casing of which is open, so that all who have eyes may see how it is constructed, and the meaning of each contact-point, each resistance, is clearly explained. He is taught how to cut out the disabled motor of a car from the controller, and how to manipulate the reversing-lever. The terms "multiple" and "series" are defined not only in unmistakable words, but objectively by means of the controller and the motors.

For this purpose the classroom is equipped with an operative skeleton-car, jacked up from the floor so that its wheels may spin with even more freedom than they would on the road. At this period the motorman enters upon the most difficult part of his education. On the road he must be able not only to run his car in a manner which will be a credit to his teaching, but he must also be able to locate open circuits whenever occasion may require. Accidents of all kinds may happen, and the pupil must be able to cope with them before he is graduated. Each man in turn is placed on the platform of the skeleton-car, is instructed practically how to operate the apparatus of which he has charge, and how to locate open circuits on a "dead" car, as it is called in road parlance. If, after having been brought to a stop, the car refuses to move when the current is turned on, the motorman knows that something must be amiss. In accordance with the teaching of the instructor, he orders the conductor—usually another pupil—to switch on the lights. When the glow within the car shows that current is at hand, the motorman steps from his platform and examines the overhead switches on both ends of the car, not, however, without removing his handles. Should the switch-handles be in proper position he inspects the fuse-boxes. If he finds that a fuse has been burnt out he proceeds to the ground-switches to cut off the current, then inserts a new fuse, replaces the ground-switches, mounts his platform again, and starts the car. But if the fuses be intact the motorman is instructed to cut out the motors in succession from the controller in order to ascertain which motor is defective. Should the lamps fail to light he examines the ground-switches. If they be properly set and the headway short, he knows that nothing can be done and that the following car must push him to the terminus. But if the headway be sufficient he continues his inspection. Entering the car he lifts a trap-door and examines the leads of the plow by which the current is fed to the motors. If the circuit be open at the regular connections the leads are replaced in position; but if they be properly connected, then the motorman knows that some injury has been sustained which he cannot repair and that his car must be pushed to the stable. This instruction in making repairs is accompanied by striking illustrations of the consequences of the motorman's breach of the inflexible rule which requires him never to leave the car-platform without removing the controller-handles. Either the instructor or an advanced pupil plays the part of an excitable, forgetful motorman—the man who, when he finds that his car will not start, leaves his controller-handle perhaps on the sixth or ninth point, frantically rushes off to renew a burnt fuse or turn a switch-handle to its proper position, and then suddenly finds himself standing alone with his car speeding away so rapidly that it cannot be easily overtaken.

When a car is disabled by an open circuit and the brakes fail to arrest the car, the motorman is instructed to pull the reversing-lever toward him and then to turn the controller-handle to the sixth point. Thus the motors are placed in multiple and converted into dynamos, sufficient power being generated to stop the car almost immediately. If an emergency stop be necessary, the brake is released, the power is reversed, the controller-handle turned to the first point, and sand applied to the rails. Should a fuse or automatic switch be blown out, the controller-handle is moved to the sixth or ninth point, whereby the car is stopped in the manner already described. The motorman must also learn that, when on a heavy grade, an open circuit requires his attention and that the brake fails to hold his car, he has only to turn the controller-handle to the sixth or ninth point to stop the car, the reversing being left in the forward position since the car is already traveling backward.

The skeleton-car is provided with the usual resistance panels, raised, however, so that they can be readily seen, and fitted with lamps which clearly indicate when the resistance is partially or entirely cut in or out of the circuit. By means of these resistance lamps, the controller, and wiring-charts, the men are taught that with the controller-handle on the first point, the 1,550-volt current furnished by the power-house passes through all the resistance; that on the second point, one-quarter of the resistance is cut out; that on the third point, one-half the resistance is cut out; and that finally when the fifth point is reached, the motors are running in series with all resistance out. The transition from the fifth to the sixth point connects the motors in multiple, the controller-handle passing over three unmarked transition points. The motorman is instructed to make this transition rapidly, so that the motors may sustain no injury from the change to multiple. On the first transition point one-quarter of the resistance is cut in; on the second transition point three-quarters of the resistance are in the circuit, the motors still being in series. On the third transition point, motor No. 2 is dropped out of the circuit. On the sixth point both motors are in multiple with three-quarters of the resistance in the circuit. On the seventh point one-half of the resistance is in the circuit; and on the ninth point, the resistance is out of the circuit, both motors running under full speed in multiple.

The training which the motorman receives on the skeleton-car is supplemented by lectures on the method of crossing avenues and streets through which other cars travel. For classroom demonstration two sets of channel-rails are used, separated any desired distance, to represent the breach in the underground conductor. The schoolmaster constantly reiterates the necessity of shutting off the power at the point indicated by long white marks on the road, and of "floating" across the break. The consequences of turning off the power without sufficient headway are shown by means of a plow used in connection with the channel-rails.

When the applicant has learnt in the school all that he need know, he must pass through a post-graduate course on the road under the guidance of an expert motorman before he is permitted to don the blue uniform which is his diploma, and to mount the platform of his own car. If the road practice prove that he has not fully grasped all that the instructor has impressed upon him, he is either sent back to the classroom, provided there is still hope for him, or summarily dismissed without ever entering the service of the company. The road is the crucial test which the training-school graduate must withstand. There all his faults and all his virtues glaringly exposed are carefully observed by the chief instructor; and there the electric-car career of many an applicant ends.

Our article has been confined to the training of the electric-car motorman. But the school is also equipped with the dummy platform of an air-motor car, and with a cable-grip. The air-motor car is controlled with more difficulty than a locomotive; and for that reason not more than ten per cent of the training school pupils are capable of manipulating its complex starting apparatus. Nowadays the cable-car grip is rarely used. In ten or fifteen years the tall model which now stands in the classroom and towers above everything else will be a relic of the bygone days of the cable-car—an interesting, antique curiosity.

Automobile News.

A long trip through Algeria has been lately made by Messrs. Joseph and Pierre de Crawhez, two prominent chauffeurs. Starting from Algiers, they proceeded toward the south, passing through Boghari, Djelfa and Laghouat, then returning by way of Bou-Saada and Aumale. The distance covered on the tour is about 850 miles, in a region where the roads are but little more than footpaths. The machines were an object of curiosity to the natives, as well as to the Europeans, who saw an automobile visit their region for the first time.

Some additional information has been received as to the operation of electric omnibuses in Berlin. An omnibus line has been lately put in operation to connect the Stettin and Anhalt depots. The Siemens & Halske vehicle with which the company has been making experiments during the last year has proved satisfactory. This omnibus has 12 places interior and 6 on the rear platform. The battery of 44 Pollak elements is placed under the seats and is sufficient for a 10 to 12 mile run. The present line is about 2½ miles long and the trip is made in 25 minutes. The fare for the whole distance is 2½ cents. Each omnibus makes about 60 miles per day; the route has some rather steep grades, reaching 7 per cent. At each end of the line is a central station for charging the batteries. The new system is said to work well and there is some talk of establishing other omnibus lines in different parts of the city.

The annual automobile race, organized by the St. Petersburg Club, had to be abandoned on account of a heavy snowfall, and postponed till a later date. The race was fixed for the 17th of February, and seven competitors were engaged, Messrs. Mazi, Barkett, Henrik and Loginoff in large machines and Sourmetz, Krouspsky and Alexieff in motocycles. The prize was a challenge cup. The day before the race the thermometer marked 18 degrees below zero (Centigrade), and thick whirlwinds of snow filled the air. Four of the competitors declined to run; the other three left the next morning by railroad for Alexandrovskaya, on the Warsaw line, from which the start was to be made. Upon arriving the starter made a tour in his machine and decided that the snow was too deep to permit of running. The jury, composed of Dr. Klimenko, secretary of the club, and two other members, then declared the race off.

The Automobile Club of America now has clubrooms adjacent to Central Park, and a fine library and grill room are provided. The Board of Governors has issued a resolution asking all members to regard the speed regulations. They strongly disapprove of an excessive rate of speed on the public highways, in disregard of the comfort and safety of other users of the common roads, as an injury to the sport and to a great industry. They expect that when members driving automobiles meet a driver of a horse or horses which are restive or frightened, the automobilists, on request or a signal from such driver, will in all cases stop and use every precaution to avoid the possibility of an accident. Any member of the club who shall be found, after a fair hearing, to be guilty of driving at a dangerous or excessive speed on the public highway, or who has disregarded the comfort and safety of other users of the same by failure to stop when requested by the drivers of frightened horses, or who has been guilty of such conduct in the use of automobiles on the highways as shall tend to bring odium or reproach on the organization, shall be duly warned and suspended, and upon the repetition of such offense, shall be expelled from the club. This step taken by the Automobile Club of America will win respect for the organization, which has always done everything in its power to help, not only the sport, but the motor industry as well.

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Correspondence.

The 7-inch vs. the 6-inch Gun.

To the Editor of the SCIENTIFIC AMERICAN:

I have followed with interest the controversy now in progress in your paper concerning the armament for the cruisers of the "California" class. It is most satisfactory to know that there are people who take such deep interest in the development of our navy as do your correspondents. It is well that our people take an active interest in such matters, and that their opinions be brought forth. While some very good points are raised on both sides of the question, erroneous ideas are apt to appear. It is to such an idea that I wish to call attention, not for mere argument's sake, but in the hope that its correction may lead to further discussion of the subject in question on a more comprehensive basis.

I refer to the communication in your issue of March 23, 1901, in which your correspondent suggests the substitution of 7-inch for the 6-inch rapid-firing guns as a means of solving the battery question of the "California" class of armored cruisers. That would be a great mistake; for there would be no gun of intermediate caliber between the 7-inch and the 3-inch (14 pounder) guns. Moreover, if an intermediate caliber could be introduced the difference in efficiency between the 7-inch and the 8-inch gun would not warrant the installation of the two on the same ship. In fact, it would be considered a very unwise policy to have two so closely related guns on one ship, be they 4-inch and 5-inch, or 6-inch and 7-inch. The 6-inch (100-pounder) is a very good "stepping stone" between the 8-inch (250-pounder) and the 3-inch (14-pounder).

One of the lessons of the Spanish war has evidently escaped the consideration of your correspondent, and that is the moral effect of rapid fire upon an enemy. What overwhelmed the Spanish gunners was not the accuracy of our fire, far from it—only from two to three per cent of the shots having taken effect; it was the rapidity of our fire that filled the air with shell that demoralized them.

It is safe to assume that the latest 6-inch gun will be able to deliver more metal within a time limit than the 7-inch gun, and with the same, probably superior, accuracy due to its more manageable size; for the smaller the caliber the greater the rapidity of fire. If the 7-inch gun were adopted, as proposed, the 8-inch gun and the 6-inch gun would have to be discarded and the 5-inch gun brought into play to fill in the gap between the 7-inch and the 3-inch guns, and that is not as effective for all-around work as the 6-inch gun against the latest ships.

The following also attracted my attention while reading the correspondence referred to, viz.:

"If fighting is the primary object of a warship, it would certainly seem that her offensive power should not be made of secondary importance to other qualities in her make-up."

According to that let us take our "Californias" and remodel them so that the machinery is reduced to ten or twelve knots efficiency, the coal capacity to about 500 tons, the high freeboard of some twenty feet to the low one of a foot and a half or two, and reduce everything else that we do not actually use in fighting. The result would be a monitor—an excellent fighting ship, but of what strategic value? Surely a monitor with four 8-inch, fourteen 6-inch, eighteen 14-pounders and twelve 3-pounders and four 1-pounder guns would be a most formidable fighting vessel, even more formidable than the "California" of the same armament before being changed. Anchor them both within fighting range and let them bang away at each other. The result would be the cruiser much the worse for the experience, due to her greater exposed surface; for her high freeboard would serve as a short stop for many shots. If, however, the cruiser be permitted to use her superior speed she would be able to accept or refuse battle. If accepting battle her speed would serve her for constant maneuvering which the slow speed of the monitor could not offset. But give your monitor speed, hence greater coal capacity, hence a greater crew, hence greater freeboard, hence greater displacement, and you have a rival for the cruiser on an equal standing. Thus it will be seen that a ship, to be an all-around fighting ship, must combine such qualities as belong to vessels of another class—the protected cruiser or even the gunboat, which are strategically excellent but offensively poor.

It seems that for all-around efficiency the "California" and class are first-class ships and I am sure that they are the result of conscientious work on the part of our naval constructors, to whose benefit it is to produce only first-class work.

CARLOS DE ZAFRA.

118 West 44th Street, New York, N. Y.

The great Serpent Mound in Ohio has been transferred to the Ohio Archæological and Historical Society.

Engineering Notes.

The Cape-to-Cairo railroad is now in operation to a point 100 miles beyond the southern line of Lake Tanganyika.

The company making cellulose for war vessels, explosives, etc., now has three large factories in successful operation, besides two cutting plants. A fourth factory is nearly completed.

The French art critic, M. Arsène Alexandre, has discovered that our machinery showed a distinct beauty of racial type. The national character was clearly marked, he thinks, even in our locomotives. This theory is an ingenious one, and is worthy of elaboration.

A scheme is on foot to start a fast line of steamers on the Thames between Kew and Woolwich. Certainly there is no river in the world that needs fast service of boats as the Thames. The boats which run to Hampton Court make phenomenally slow time. They are retarded by the locks.

The sizes of anthracite coal and the screens through which they are made are as follows, says Steam Engineering: Coal which runs through a screen having a mesh of 3-16 of an inch is called barley; ⅜, rice; 9-16, buckwheat; ⅞, pea; 1½, chestnut; 2, stove; 2¾, egg; 4½, grate; 7, steam. Coal beyond this size is known as lump coal. Bituminous lump coal passes over bars 1½ inches apart; bituminous nut coal passes through bars 1½ inches apart; slack coal passes through bars ¼ of an inch apart.

Germany offers abundant market for a large number of American commodities, especially in the way of office furniture and supplies. The safes are mostly of obsolete types with old-style locks, and judicious efforts on the part of our manufacturers would result in large sales of our medium styles store and office safes. German offices and stores are rapidly adopting modern furniture including desks, typewriters, file cases, cash-registers, etc., and safes will prove equally as popular. Heidelberg students carry ink in bottles to and from classes and, indeed, the fountain-pen seems to be very little known in Germany.

In December a serious country fire occurred along the line of the Great Southern Railway in the Argentine. It extended 60 miles, and burned some freight rolling stock as well as telegraph poles and fence posts. The fire appears to have been spread by the great amount of "paja voladora," or flying grass. It is blown about by the wind and whatever care the railroad companies may take naturally they cannot keep it off their right of way so long as it exists. It is difficult for the trains to cut their way through it, and it causes hot boxes and even derailments, while foremost of all is the terrible danger of its taking fire. The shifting of the wind a few points after the section hands have cleared the track of the flying grass may result in its immediately being buried in the dangerous stuff again.

Vaucluse, in South France, is a center of the ocher industry. Sometimes the ocher is excavated direct without mining, but often shafts are sunk. The material when brought to the surface is transported to the valley below on carts and is then washed. Mining is only done in the winter season, as the watercourses are dry in summer. By means of successive settling basins various degrees of fineness are secured in washing the ore. At the end of the winter these basins are filled with ocher in the form of mud, which dries hard during the heated term, and is then cut into blocks of regular size and dried in the sun. It is then either cut into blocks or crushed into powder for shipment and is sorted for color; the yellow shades command the highest price. The total production of these mines last year was about 180,000 tons, and of this amount 3,000 tons were shipped to the United States. Although the mines have been worked for many years they are not exhausted.

The London County Council have issued their annual report reviewing the work accomplished in the metropolis during 1899 concerning tramways, dwellings, and numerous other schemes which were carried out at an aggregate cost of more than $56,250,000. Twenty-three miles of new thoroughfares were undertaken, which will result when completed in an increase in the population under the jurisdiction of the Council from its present 4,700,000 persons to 7,096,400 persons. The maintenance of the Fire Brigade cost $1,000,000, while a similar sum was expended upon the drainage of the city. The present sewers are too small to cope with the rapidly-increasing exigencies of the population, and a new scheme for reconstructing the drainage system is being projected at a cost of $15,000,000. London possesses 3,809 acres of open spaces and parks, to maintain which cost $572,575. In 1889 the cost in this direction was only $263,755. The Council also maintains the coroners' courts and the asylums; is responsible for the highways, bridges and public health; controls the theaters and music halls; and attends to the enforcement of the Weights and Measures act, in which 1,100 offenses were punished during the year.

Electrical Notes.

The London United Tramways, upon which electric traction has been introduced in place of horses, are meeting with considerable opposition from the scientists of Kew Observatory. A section of the line passes within three-quarters of a mile of that building and the observers complain that their delicate instruments are deranged and the records spoiled by the near neighborhood of the electric current. The Board of Trade have the matter in hand, and experiments are to be carried out to ascertain to what the electrical disturbances at Kew will amount, and the best methods of insulation. The tramway engineers do not feel disposed to resort to elaborate and expensive means for insuring complete insulation, so that a complete deadlock is the result, and the tramways cannot yet be opened to public traffic.

The separation of wireless messages is now receiving great attention by electricians. M. P. Jégou has adopted a new system in which he employs mast-wires of different ranges. Four such mast-wires are employed, two at the sending station and two at the receiving station. Their heights are so arranged that one of them covers, say, a range of five miles, while the other does not. The circuits of the coherers attached to the two mast-wires are so arranged that their simultaneous action produces no effect upon the galvanometer, but at a distance of five miles the galvanometer will respond to a message from the sending stations addressed to both coherers, as only one of them is brought into action. At half the distance when both coherers are within range no effect is produced on the galvanometer.

There is a project on foot for the construction of a movable electric platform on the right bank of the Seine. It will be underground and its length will be about six miles. The route proposed passes under the Avenue de l'Opera, the great boulevards, Boulevard Sebastopol, the Rue Turbigo and the Rue de Rivoli. The new scheme calls for four platforms instead of three as was in use at the Exposition. The first platform will be stationary, the second will have a velocity of 1½ meters a second, the third 3 meters and the fourth 5 meters or 16⅛ feet. This will enable pedestrians to have a very rapid means of transit afoot, in a portion of Paris which is greatly encumbered by vehicular traffic, for as all the locomotion is in one direction persons can walk very fast on the fourth platform, and will be able to cover a great distance. Some means of transit on the streets mentioned is so necessary that it is very likely the scheme will be carried into effect.

Attempts are being made by the Marconi Wireless Telephone Company, of London, to inaugurate a wireless telegraph service to Australia. Although the total distance is considerably in excess of that from England to this country, it can be more easily negotiated owing to the facilities offered at various points en route, for the installation of subsidiary transmitting stations. Arrangements are being made to erect stations at Prawle Point, the Lizard, Ushant, Cape Finisterre, Gibraltar, Malta, Algiers, Sardinia, Sicily, Cape Malea in Greece, Alexandria, Aden, Socotra, Colombo, Sumatra, the Cocos Islands, Perth, Albany, Adelaide, and Melbourne. The various governments of the countries in which these points are situated are being approached to obtain permission to install the stations. In no single instance is the span between two points so great as that from the west of Ireland to New York, so that, if success attends the experiments in this case, it will probably be equally possible to extend the distance and to establish ether communication between this country and Great Britain. If the vessels plying between England and the Antipodes are supplied with instruments, it will be possible for passengers to dispatch and receive messages during the voyage.

A new process for making plates of porous lead for use in accumulators or for acid filters has lately been patented in Germany by Richard Bauer. In place of treating the melted lead by a jet of gas or vapor, as is often done, the inventor uses a material which by contact with the melted metal is volatilized and penetrates through the mass during the cooling. Sulphur is best adapted for this purpose; it has the property of combining with the lead to form sulphide, and this sulphide when decomposed by dilute hydrochloric acid leaves a mass of porous lead. In practice the operation is carried out as follows: The two halves of a plate mould are heated and a small quantity of melted sulphur is introduced, so that after cooling the sides of the mould are covered with a layer of sulphur. The lead, heated to redness, is then poured into the mould; the sulphur is vaporized and penetrates into the mass. After cooling, the plate taken from the mould is composed of lead, sulphide of lead and an excess of sulphur. The latter is removed by a preliminary washing and the plate is then treated with dilute sulphuric acid, which decomposes the sulphide and leaves a plate of pure lead which is extremely porous and well adapted for accumulators and other uses.

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THE OMNIGRAPH—AN INSTRUMENT FOR TEACHING TELEGRAPHY.

Old telegraph operators will still remember how messages were once received on a tape driven by a clock train. The skill acquired soon rendered it possible to dispense with the tape and to translate the message directly from the sounder. But the acquisition of that skill came only with long practice; for which reason the modern novice must spend hours and hours before the ticking of a sounder becomes instantly intelligible to him. An instrument which is designed to simplify instruction in telegraphy, and to impart in a comparatively short time a complete knowledge of the Morse alphabet, has recently been introduced by the Omnigraph Manufacturing Company, of 39 Cortlandt Street, New York city. Patents have been applied for.

The Omnigraph, as the instrument is called, consists of a baseboard on which are secured an ordinary key and sounder, between which a disk is mounted, formed on its periphery with teeth. A spring contact adjacent to the wheel engages the peripheral teeth of the disk. Although irregular, the arrangement of the teeth is arbitrary. For if the disk be rotated by means of a small crank-shaft geared with the disk-shaft, the spring contact is forced outwardly by the teeth, but drops back by its own elasticity, and thus makes and breaks the circuit. The experienced telegraph operator detecting these makes and breaks at the sounder, recognizes them as the dots and dashes of the Morse alphabet. A close inspection of the disk would reveal to him that the teeth are so arranged as to spell the sentence, "John quickly extemporized five tow bags." If the disk be rotated forwardly, this sentence, thus oddly worded to include every letter in the alphabet, is ticked off at the sounder; if rotated in the opposite direction, the sentence will be telegraphed backward.

The disk is completely under the control of the student. It can be rotated as slowly as desired; or it can be so rapidly turned that its curious sentence will be received at the sounder with a speed that would open the eyes of a good operator. Moreover, the message on the desk is transmitted with a distinctness and faultlessness which the most perfect operator can never hope to attain. At first blush it might seem that the student simply learns one sentence forward and backward, and that the instrument is a good teacher only within very narrow limits. But this disk can be partially rotated forward and backward any number of times, in any place, so that the letter to be transmitted cannot possibly be anticipated. Thus the student learns how to receive a cipher message, the meaning of which he cannot know.

When sufficient proficiency has been obtained in receiving messages from the sounder, the student can learn to transmit messages in the regular method by means of the key which forms part of the apparatus.

THE OMNIGRAPH.

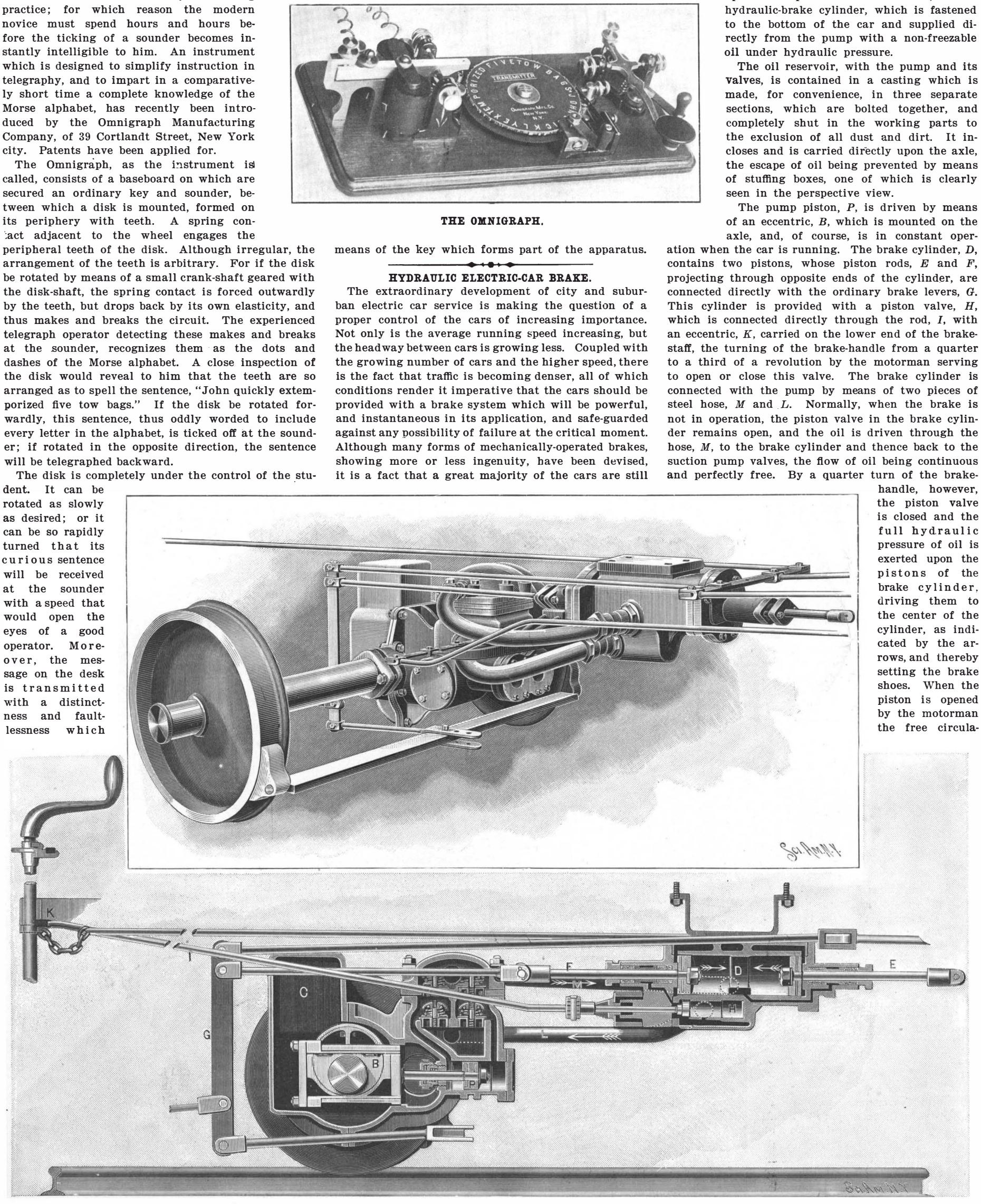
HYDRAULIC ELECTRIC-CAR BRAKE.

The extraordinary development of city and suburban electric car service is making the question of a proper control of the cars of increasing importance. Not only is the average running speed increasing, but the headway between cars is growing less. Coupled with the growing number of cars and the higher speed, there is the fact that traffic is becoming denser, all of which conditions render it imperative that the cars should be provided with a brake system which will be powerful, and instantaneous in its application, and safe-guarded against any possibility of failure at the critical moment. Although many forms of mechanically-operated brakes, showing more or less ingenuity, have been devised, it is a fact that a great majority of the cars are still controlled by the old hand-brake; and while this is fairly efficient, it has the drawback of being slow in its application, whereas in cases of emergency, the gain of a fraction of a second in the action of the brake may be of the most vital importance.

We present two engravings, one a perspective and the other a sectional view, showing what is known as the Neal-Duplex brake, which is operated on the hydraulic principle, and has the advantage of being applicable to any standard car, and of being operated by the same brake handle to which the ordinary chain-brake is attached, and available for use at any time. The device consists essentially of a pump carried upon and operated from the axle, and a hydraulic-brake cylinder, which is fastened to the bottom of the car and supplied directly from the pump with a non-freezable oil under hydraulic pressure.

The oil reservoir, with the pump and its valves, is contained in a casting which is made, for convenience, in three separate sections, which are bolted together, and completely shut in the working parts to the exclusion of all dust and dirt. It incloses and is carried directly upon the axle, the escape of oil being prevented by means of stuffing boxes, one of which is clearly seen in the perspective view.

The pump piston, *P*, is driven by means of an eccentric, *B*, which is mounted on the axle, and, of course, is in constant operation when the car is running. The brake cylinder, *D*, contains two pistons, whose piston rods, *E* and *F*, projecting through opposite ends of the cylinder, are connected directly with the ordinary brake levers, *G*. This cylinder is provided with a piston valve, *H*, which is connected directly through the rod, *I*, with an eccentric, *K*, carried on the lower end of the brake-staff, the turning of the brake-handle from a quarter to a third of a revolution by the motorman serving to open or close this valve. The brake cylinder is connected with the pump by means of two pieces of steel hose, *M* and *L*. Normally, when the brake is not in operation, the piston valve in the brake cylinder remains open, and the oil is driven through the hose, *M*, to the brake cylinder and thence back to the suction pump valves, the flow of oil being continuous and perfectly free. By a quarter turn of the brake-handle, however, the piston valve is closed and the full hydraulic pressure of oil is exerted upon the pistons of the brake cylinder, driving them to the center of the cylinder, as indicated by the arrows, and thereby setting the brake shoes. When the piston is opened by the motorman the free circulation of oil takes place as before. This brake, which was invented by J. H. Neal, and is manufactured by the United States Steel Company, 145 Oliver Street, Boston, Mass., is the outcome of considerable experience in the operation of the Boston Elevated Railway Company's system, and it has many advantages



HYDRAULIC ELECTRIC-CAR BRAKE.

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which have been proved by the test of actual service. In the first place, it is instantaneous in its action, the brake being set, as we have said, by a quarter turn of the brake handle, and the appreciable delay which occurs in the winding up of an ordinary hand-operated chain-brake avoided. Another most important advantage, which will be appreciated by the repair shop, is that the actual locking or "skidding" of the wheels is impossible, the brake being under automatic control; for should the wheel, and, therefore, the pump, stop, the pressure on the brake cylinder piston heads is lowered, and the braking effect removed. At the same time the motorman has at command the full efficiency of the ordinary chain-brake. The mechanism is adjustable to any brake that allows 6 inches or more of axle space. Its total weight is less than 500 pounds, and the cost of power for its operation is, practically, nothing at all. The whole brake being carried in an air-tight casing filled with oil, the mechanism is self-lubricating, and repairs, as proved by actual operation, are very light.

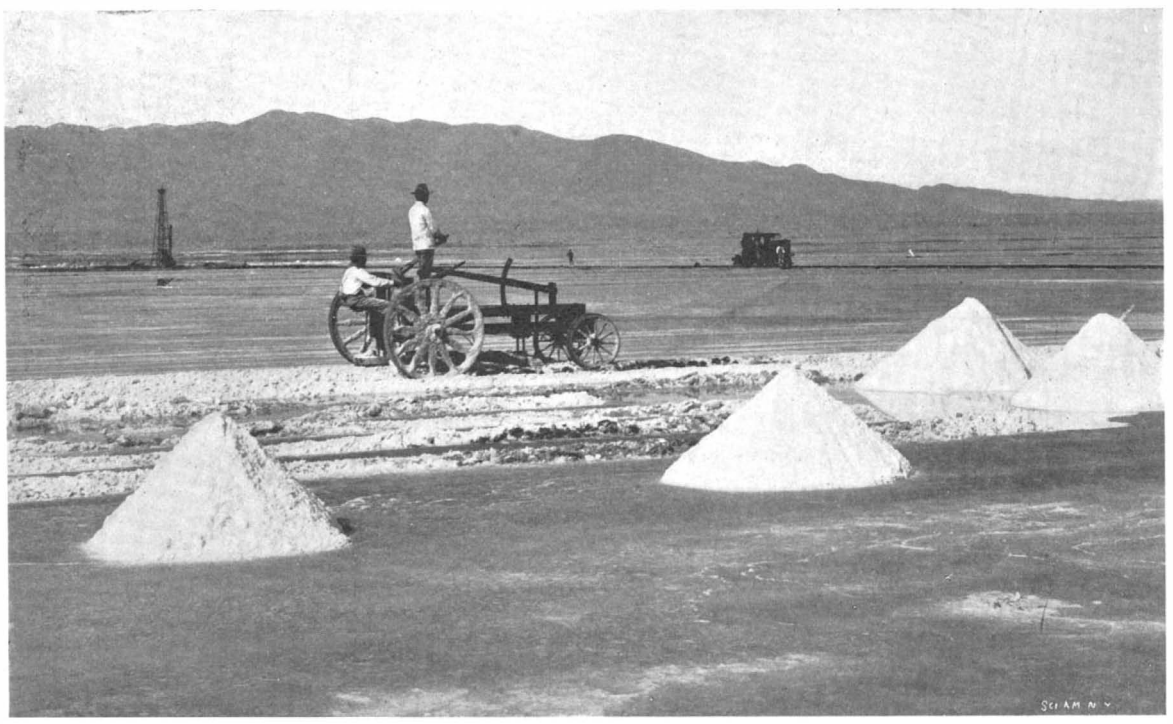
A REMARKABLE SALT DEPOSIT.

BY CHARLES F. HOLDER.

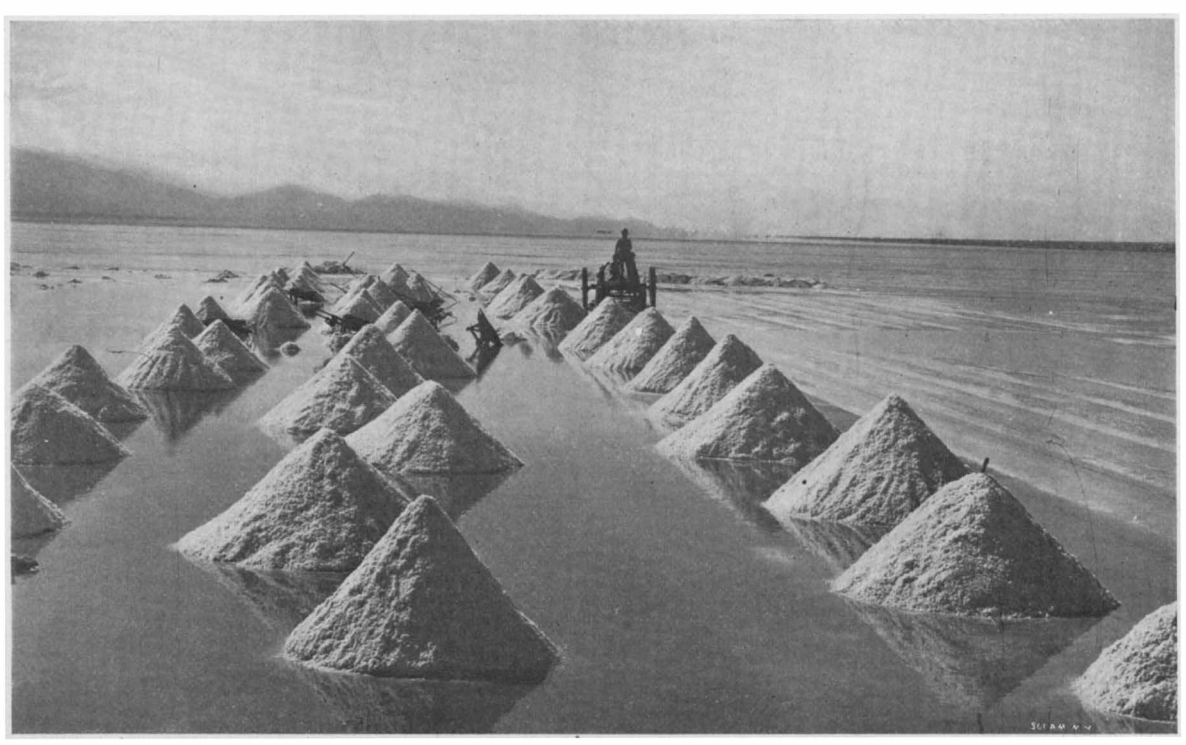
Few readers of the SCIENTIFIC AMERICAN had heard of the Sea of Salton up to 1892. At this time the Colorado River broke its barriers and flowed into the desert of California, flooding it to an extent of hundreds of square miles. In the vicinity of Salton was one of the largest salt deposits in America; the water encroached upon it, and for a time threatened the industry, but after creating an excitement which spread over the entire West, it receded. The rumor was to the effect that the new sea was so vast that it would change the climate of Southern California.

The deposit of salt at Salton is one of the sights of California. It lies in a depression almost three hundred feet below the sea level, and was at some time in the past the bed of a sea, or extension of the Gulf of California. From the train, which passes nearby, the tract looks like a vast snow field, and in the early morning is frequently the scene of beautiful mirage effects. The salt deposit, which is essentially rock salt, covers about one thousand acres, and is at present the center of interest on account of the dispute of rival companies over the possession of the property. The company in possession has shipped from this place annually about two thousand tons of salt, valued at from $6 to $34 per ton, according to quality. The outfit of the salt mine consists mainly of a crusher, a drying building, and a dummy line from the salt beds to the Southern Pacific Railroad, not far distant. The work is carried on mainly by Indians, who can withstand the intense heat of the desert—150 deg. in June—and the glare better than white men. The work is interesting and novel. The drying house is a building six hundred feet in length, about which hundreds of thousands of tons of salt are heaped, having all the appearance of snow. Here the salt is dried and milled. The salt is collected at first with a plow—a singular machine with four wheels, in the center of which sits an Indian guiding it; the motive power is a dummy engine some distance away, which hauls the plow along by cables. As it passes, the steel breaker is seen to cut a broad but shallow furrow, eight feet wide and three feet long, throwing up the ridges on either side. Indians now follow along, and with hoes pile up the salt in pyramidal forms, which later is transported to the mill. Each plow harvests seven hundred tons of salt per day. A singular feature of this bed is that the salt is being deposited daily by springs which run into the basin, and as the water evaporates it leaves a crust of almost pure chloride of sodium, which ranges from ten to twenty inches in thickness, over the lake. It will be seen that there is no danger of exhausting the supply, which is forming all the time; and, in point of fact, the plows have in the past years worked almost continuously over the same area, only about ten acres having been plowed.

The salt, when delivered at the plant, is hoisted to the upper floor and placed in a bulkhead breaker, where it is reduced to particles of the same size. It then passes through a burr mill and is well ground. After this it is sifted and is finally passed through an aspirator, which cleanses it of all foreign material, when it is ready for packing in bags. The salt is used for a variety of purposes, and is of several different grades, the lowest being unrefined—a product called hide salt, used in manufactories. Large quantities are sold for sea-bathing purposes, a certain amount producing a very similar chemical equivalent to sea water. Other grades are prepared for the table, dairy and for the use of druggists.



SALT DEPOSITS AT SALTON, CAL.—SIDE VIEW OF SALT PLOW.



PILING THE SALT AT SALTON, CAL.—280 FEET BELOW THE LEVEL OF THE SEA.

Copper Casting.

For some purposes, such as valve seating and the like, states Walter J. May, in The Practical Engineer, copper has considerable advantages, but there is usually some trouble in getting them sound; in fact, many brass-foundry people say that sound castings cannot be made in copper, and probably such has been their experience, using ordinary brass-foundry moulding and cheap brands of copper; but all the same for that, under proper conditions, copper can be cast as readily and as soundly as gun metal if you go the right way to work. In the first place, you require good metal, and probably you cannot do better than use good new sheet scrap, as this would give the highest grade of tough metal at a moderate price, and such metal as would probably give the best castings. At the same time, old sheet scrap, when carefully cleaned from tin and solder, gives very good castings, but the waste is greater, this often more than balancing the difference in price.

Having your copper, it should be melted in crucibles kept for copper only, and it is well to use the best non-sulphurous coke for melting. Gas coke holds too much sulphur to be useful, and some of the hard cokes are not to be recommended for the best work, as some of the impurities get into the metal at times. Clean melting is essential to obtaining good results, and must not be overlooked.

In preparing the moulds care must be taken to ram fairly hard, and to vent well, giving large runners, and, where required, risers, but the gates should be only of ordinary size as for iron. Thin sprues are not desirable, as it is policy to keep the connection between the runner and casting fluid until the latter has set, so that metal can keep drawing in until contraction ceases; in fact, the writer has found that a large head of metal and moderate feeding is of great assistance; therefore, in making moulds this should be provided for. The moulds should be coated—sleeked—over with plumbago, and dried, and, needless to say, the boxes should fit well. So far as possible a slight inclination from the pouring gate should be allowed when setting the boxes for pouring; but due attention to the shape of the castings must be paid in arranging this part of the business. The metal should be poured hot, and the feeding rod should be kept at work longer than for iron, and the castings should not be opened out before they are black hot or even cold. In every case it will be necessary to flux the metal, and for this purpose either muriate of ammonia and chalk, well ground together in equal proportions, or roughly-crushed chloride of manganese, should be used, from 4 ounces to 12 ounces to the hundredweight of metal being necessary, according to local requirements; but the writer finds that either of these is effective. In applying these fluxes, they may only be put into the metal after it is melted, the best time being soon before the crucible is taken from the furnace, throwing the flux on the metal and well stirring in, not taking the crucible from the fire until the fumes have ceased. It is no earthly use putting chloride fluxes into the pot before the metal is melted, as you only destroy the pot and make a stink by so doing, without affecting the metal. You are not using glass or other hard material that has to be melted, it must be remembered, and if you want to obtain the due effect from any flux which you are using you must add it when it will be effective.

There is no reason why copper should not be cast as soundly as brass, although it needs more care, and copper can be hardened, if necessary, to the hardness of mild steel; but alone, copper would not make a good bearing metal. The small amount of manganese added in using the chloride mentioned above does not seriously affect the copper, if it is of good quality to start with.

The difference between the specific heats of cobalt and nickel increases as the temperature rises. According to the results obtained by Pionchon the specific heat of nickel is at first a little greater than that of cobalt, and becomes very much less at higher temperatures. The electrical conductivity is very different for the two metals. Taking silver as 100, cobalt equals 17.22, and nickel 13.11.

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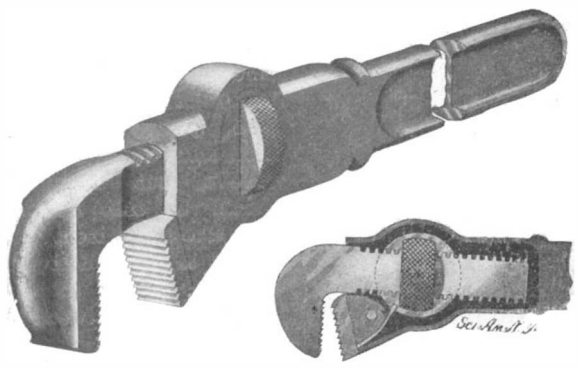
AN IMPROVED PIPE-WRENCH.

The illustration presented herewith pictures a novel pipe-wrench which has been recently patented by Charles M. Ingersoll, of Summit Hill, Penn. The wrench has a hollow body in which a rolling carrier is mounted. Through this carrier the threaded shank of the movable jaw of the wrench is passed. By means of a nut which encircles the shank, and which is fitted in the carrier, the movable jaw can be adjusted to grip pipes of various sizes. The fixed jaw is mounted at the lower front portion of the wrench, and is formed with



THE INGERSOLL PIPE-WRENCH.

a lug engaged by a transverse pin. By reason of this simple arrangement the fixed jaw is rigidly, though removably held in place. The fixed jaw presses against the end of a spring and holds it firmly in position. The free end of the spring is connected with and actuates the rolling carrier. The spring is so set that it tends to throw the inner end of the shank of the movable jaw upward, holding the shank and jaw, when not operating, in the position shown by the larger illustration.

By turning the wrench in the usual manner when a pipe is to be gripped, the oppositely-ratcheted faces of the jaws will engage the metal. When the working strain on the wrench is relaxed, and movement of the wrench reversed to recover the grip of the jaws on the pipe, the shank of the movable jaw is moved by the force of the spring so that its inner end is thrown up. Thus the jaw itself is pressed yieldingly against the pipe. The jaws, by reason of this arrangement, can be moved idly over the pipe to recover their grip; when the wrench is moved again to turn the pipe, the jaws are again brought into action.

It will be observed that, owing to the protrusion of the jaws, the wrench is enabled to turn a pipe close to a wall or ceiling.

A NEW WICKLESS OIL BURNER.

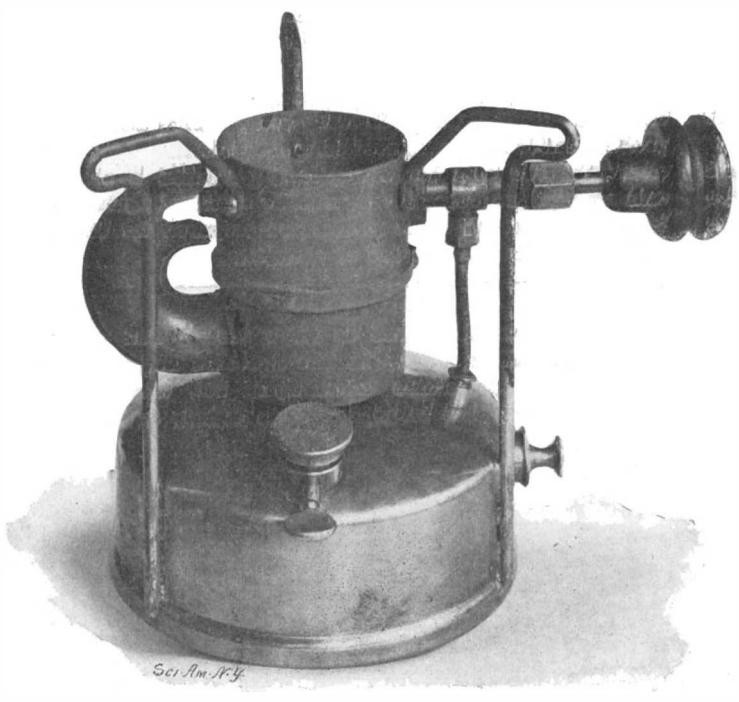
The possibility of generating from common kerosene or petroleum a gas equal in heating power to that obtained from the street mains of a large city is something that has long been desired. The difficulty has been that in heating oil to a vapor there is a certain proportion of carbon that adheres to the tubes through which the vapor passes, and in a short time the generator tubes are filled with this deposit and rendered useless. It is difficult to remove this pipe carbon, and this has been one of the reasons why the use of petroleum has met with little success.

But in the modern improved burners which have been introduced by the Hydrocarbon Burner Company, of 197 Fulton Street, New York city, which form the subject of the present article, the difficulty is very simply overcome. A novel cleaning device is now used, which answers all requirements and insures a steady flow of vapor.

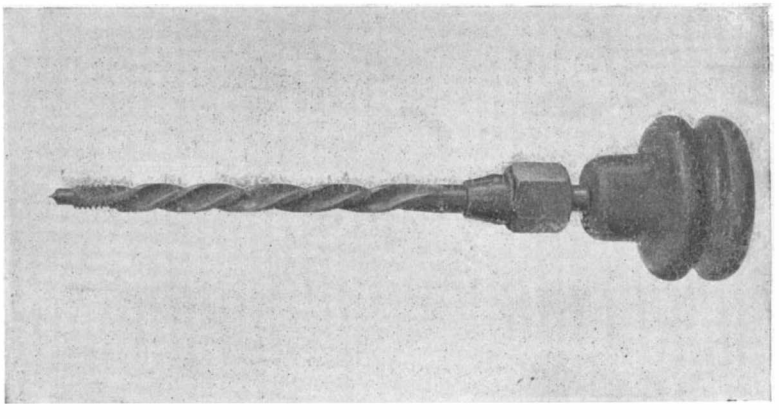
The improved hydrocarbon burner consists of an oil-reservoir provided with an air-pump and with a filler-cap, on which reservoir a burner is supported by three standards. By means of the air-pump sufficient pressure is obtained to force the oil upwardly through a small tube into the vaporizing-tube extending horizontally above the burner. From the vaporizing-tube the vaporized oil passes into an air-tube curved downwardly and terminating beneath the burner. The vaporizing and air tubes are not directly connected, but are slightly separated so that the vapor, in bridging the space between the tubes, is mingled with sufficient air to give an intensely hot, blue flame. The vaporizing-tube is located above the burner, so that the oil may be converted into gas by the heat of the burner. In order to start the generation of gas, the vaporizing-tube is first heated by alcohol. As soon as the burner is ignited, vaporization proceeds automatically.

To control the flow of vapor from the vaporizing-tube to the air-tube, a needle-valve is employed. And the particular formation of the stem of this needle-valve constitutes one of the most important features of the apparatus. For the stem in question is not merely a straight rod, but an auger, or screw, which permits the passage of oil, and also acts as a cleaner. A slight rotation of the valve causes the auger-like stem to remove from the entire interior wall of the vaporizing-tube the accumulation of carbonized matter. By this simple device, the tube can be readily cleaned whenever desired, and the regular flow of oil and gas at all times controlled.

The present device seems practical, and is said to be efficient in removing carbon from the tubes by the ordinary operation of the stove, at the same time keeping the exit opening for the vapor clear of obstructions. It has great power. The pump which forces the oil into the burner gives any reasonably strong power desired. By means of the needle-valve, the power can be so regulated that a flame can be obtained, varying from a consumption of 35 feet of gas per hour to 1 foot of gas per hour. This principle can be applied to a larger burner of greater power.



AN IMPROVED HYDROCARBON BURNER.



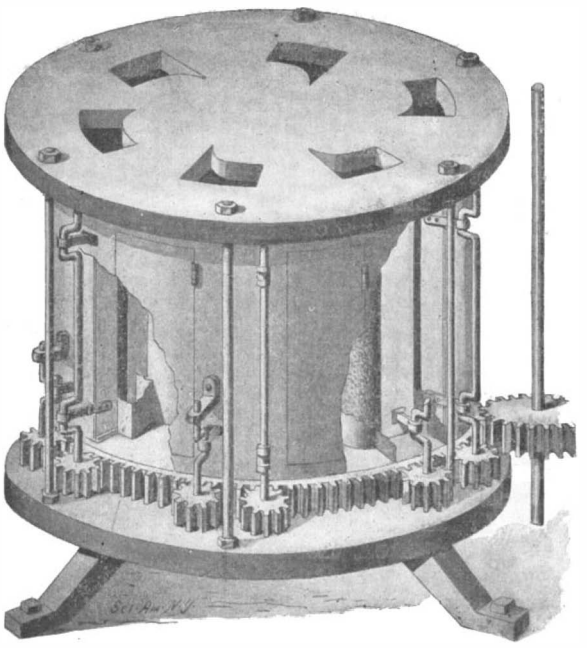
THE NEEDLE-VALVE AND ITS AUGER-STEM.

THE WENTWORTH COTTON-GIN.

Cotton-growers have ever been reluctant to cultivate long, fine staple cotton for the reason that the proper gin to separate the lint from the seed and to prevent the breaking and cutting of the fiber has never been invented. The objections to existing machines seem, however, to have been overcome by Mr. William H. Wentworth, of Fort Sam Houston, San Antonio, Texas, who is well known as the first successful grower of Egyptian cotton in America.

Mr. Wentworth's experience with the roller system of ginning taught him that the main disadvantages encountered were slowness or lack of capacity, and the impossibility of treating any but the long free ginning cottons. In the belief that our common cottons, if ginned in the roller process, would command better prices he associated himself with Mr. Otto Klaus, of the same town, and patented the gin which forms the subject of the accompanying illustration.

In the Wentworth machine the seed-cotton is fed through openings in the head of the gin-casing to a series of compartments each containing a ginning-roller covered with hide, the hair of which has been cut short. In each compartment are vertical feed-boards pivoted at their upper ends. Between the feed-boards and the rollers the seed-cotton falls, the feed-boards being reciprocated to force the seed-cotton to the rollers. Vertical seeding-blades each coact with a roller, one of the blades being fixed and the other movable to and from the fixed blade. The rollers conduct the cotton to the space between the fixed and movable blades. By reason of the operation of the coacting fixed and movable blades the cotton-seeds are forced from the fiber. The bottom of the casing of the machine is provided with a central opening for the fiber and openings for the seed.



THE WENTWORTH COTTON-GIN.

The driving mechanism comprises a system of gearing which consists of a master-wheel having teeth on its inner edge meshing with gears on the rollers and teeth on its outer edge meshing with pinions on the cranked shafts by which the feed-board and movable blades are operated.

The capacity of the machine is regulated by the number of rollers used, one roller representing one bale per day. The hide covering of these rollers grips readily the short-linted common cottons. A gin of ten rollers will occupy about the floor space of one horizontal roller gin, or 15 square feet.

New Alkaloids of Tobacco.

Three new alkaloids of tobacco have been isolated by Messrs. A. Pictet and A. Rotschy. One of these has received the name of nicoteïne ($C_{10}H_{12}N_2$). It is a liquid body, easily soluble in water and the organic solvents, and has a strongly marked alkaline reaction. Its odor is agreeable, somewhat resembling that of parsley. It is extracted from nicotine in the proportion of two per cent. The second alkaloid is solid, and has received the name of nicotelline. It appears in the form of small prismatic needles, melting at 148 degrees C. The proportion of this body contained in tobacco is extremely small. It is but slightly soluble in water and ether, but dissolves easily in alcohol and chloroform. The third alkaloid, which has not yet been well examined, has been called nornicotine; its composition appears to be very close to that of nicotine, and it is supposed to be derived from it by the elimination of the methyl group attached to the nitrogen. The physiological action of these substances has not yet been determined.

The Current Supplement.

The current Supplement, No. 1318, is filled with interesting articles. The first-page engravings are views in Taormina, one of the most beautiful places in Sicily. "The Effect of Physical Agents upon Bacterial Life" is a very practical article by Dr. Allan Macfadyen. "Information Concerning the Angora Goat" is concluded. "The Oil Fields of Baku" is by Prof. G. Frederick Wright. "The Museum of Artillery at Paris" is accompanied by a large number of interesting engravings showing arms and armor. "Wooden Railways" dsecribes some curious old railways. The third installation of "American Engineering Progress" deals with the "Influence of Combination," which is very timely at the present moment. "A New Elliptical Cutting Machine" is by Prof. C. W. MacCord.

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RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

REVERSING APPARATUS FOR ELECTRICAL DEVICES.—ROBERT J. HUGHES and ALEXANDER B. SHAW, Duquesne, Pa. This apparatus comprises a reversing controller for connecting the terminals of an electric generator interchangeably with the wires of a two-wire line. The device dispenses with one set of wires usually employed in electric travelers to be found in machine-shops, and enables the motor on the traveler to be reversed with only one set of wires. By means of the novel reversing device employed the current passes through the field-coils as before, but is made to change its direction in the armature-coils in order to drive the motor in the desired direction.

Mechanical Devices.

CHIP-BREAKER. — WALTER L. CROUCH, Thomaston, Conn. The purpose of this invention is to provide a more efficient chip-breaker for molding and similar wood-working machines than has hitherto been known. The invention comprises a carrier arranged to rock around the axis of a rotary cutter and carrying a finger which engages the work to break the chips, and which moves concentrically to the axis of the rotary cutter.

KNEADING AND MIXING APPARATUS FOR SOAP.—ANATOLE and ERNEST DES CRESSONNIERES, Brussels, Belgium. The crushing, kneading and mixing apparatus is designed to subject the soap to an alternate crushing and mixing treatment in shavings, instead of subjecting it to simple crushing by means of three cylinders, thus enabling an absolute homogeneity of the paste to be obtained and permitting its mixture with color while preventing waste of soap. This alternate crushing and mixing is obtained by the arrangement of crushers in couples of two cylinders each provided with a scraping comb and placed in such a way that the shavings from the two coupled cylinders are intermixed for crushing by the next crushing-cylinders, and so on up to the last.

DIPPING-MACHINE. — JOHANN A. JENA, South Bend, Ind. The invention relates to machines for dipping, and particularly for enameling crockery and other goods. At the upper portion of a vat a dish-holder is journaled, provided with end portions having apertures. A rack has a longitudinal inner member adapted to be seated upon the peripheries of the end portions of the holder. Arms extend from the rack inwardly beyond the inner member, and are provided with projections adapted to fit into the apertures of the end portions.

DYNAMOMETER.—KARL LEVERKUS, Charlottenburg, Germany. The dynamometer serves to measure power transmitted from one shaft to another. In the dynamometers usually employed the relative revolution or distortion of the members of which they are composed is too small to render the measuring of the power easy and exact. To remedy this defect the inventor employs a toothed gearing for increasing or enlarging the motion of the lengthwise-movable part. Moreover, this lengthwise-movable part is provided with longitudinal and spiral grooves engaged by rollers on the movable part and the one member. The efficiency of the apparatus is increased and the cost of manufacture very considerably reduced.

ACTUATING MECHANISM FOR RETAINING VALVES IN AIR-BRAKE SYSTEMS.—EDWIN J. EMMONS, Brandon, Manitoba, Can. Mr. Emmons has devised a means by which all the valves are under the control of the engineer and can be simultaneously operated, the ordinary air signal-pipe of the train being utilized. The actuating mechanism comprises an air-motor having connection with the stem of the valve and with the air signal-pipe. The signal-pipe is connected with the main reservoir, and is provided with a reducing valve. The pipe has a controlling-valve. A signal-valve has connection with the pipe. By means of this invention the brakemen are no longer required to turn the handle of each retaining-valve to close the exhaust from the brake-cylinder to keep the brakes on while the engineer is recharging the auxiliary cylinders.

Designs.

TWINE-CUTTER.—BEVERLY P. HERNDON, Florence, Arizona Territory. The device consists of a ring adapted to receive one of the fingers of the hand and an S-shaped prong or arm formed in one piece with the ring and projecting laterally thereform, the same being adapted to pass over the finger adjacent to the ring and under the next one, so that the device may be conveniently held. The cutter proper is attached to the side of the ring opposite the spring, and arranged transversely thereon, so as to be adapted for convenient use.

BOLT-GUARD.—WILLIAM TAYLOR, 40 East Harrison Street, Chicago, Ill. The bolt-guard is designed for use on doors to prevent the insertion of a case-knife or other thin blade for the purpose of throwing the bolt back. The guard is formed to present an obstruction to the entrance of the blade and so prevent its adjustment into engagement with the bolt and thus forms an efficient guard for the purpose.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send your name and address to the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 299.—For a machine for making ice in small quantities adapted for hotel and family use.

For logging engines. J. S. Mundy, Newark, N. J.

Inquiry No. 300.—For dealers in electrical supplies, such as small motor and dynamo castings, etc.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 301.—For gas engine adapted for acetylene gas.

Motor Vehicles, Duryea Power Co., Reading, Penn.

Inquiry No. 302.—For wholesale dealers in rifles and sporting goods.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 303.—For manufacturers of special wooden and sporting articles suitable for the German market.

Yankee Notions. Waterbury Button Co., Waterbury, Ct.

Inquiry No. 304.—For a carriage elevator, platform 8 by 15 feet, to hoist 11 or 12 feet, capacity 1,500 to 2,000 pounds, completed and put up.

Brass Cups, Threaded. Bliss Chester Co., Prov., R. I

Inquiry No. 305.—For the manufacturers of the "Pan-American Electric Lamp."

La Porte Watch School, La Porte Ind. Catalogue free.

Inquiry No. 306.—For catalogues of paint-making machinery.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 307.—For parties who drill deep wells with a core or bit drill.

Machine chain of all kinds. A. H. Bliss & Co. North Attleboro, Mass.

Inquiry No. 308.—For machinery for extracting grease and moisture from wet glue stock and other animal refuse.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 309.—For manufacturers of pressed steel for metal boxes.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 310.—For manufacturers or dealers in cheap albumen, such as that taken from blood, etc.

SAWMILLS.—Variable friction feed. Send for Catalogue B. eo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 311.—For parties to make an apparatus for baking talc.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 312.—For manufacturers of motor fans for stores, rooms, etc.

Wanted. Pan Am. Exposition Patent Novelties suitable for souvenirs. Address J. M. B., 320 B'way, N. Y.

Inquiry No. 313.—For Grimme, Natalis & Co.'s calculating machine.

For Machine Tools of every description and for Experimental Work call upon Garvin's, Spring cor. Varick Street, N. Y.

Inquiry No. 314.—For the manufacturer or dealer in the "kinodrome."

Guns and Sporting Goods. Keating Wheels. New catalogue out now. The H. & D. Folsom Arms Co., 314 Broadway, New York.

Inquiry No. 315.—For a new, novel and ornamental article for sale in the country, not high in price.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 316.—For a practical automobile adapted to carry six passengers, the operator and some freight; gasoline preferred.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 317.—For machines for making spring tickets.

Government Relics—guns, swords, revolvers, saddles, cannons, etc. from Goverment Auction are now being sold at ridiculously low prices. Send for illustrated lists. Francis Bannerman, 579 Broadway, N. Y.

Inquiry No. 318.—For manufacturers of aluminium novelties.

Wanted—Revolutionary Documents, Autograph Letters, Journals, Prints, Washington Portraits, Early American Illustrated Magazines. Correspondence Solicited. Address C. A. M. Box 773, New York.

Inquiry No. 319.—For hard wood veneer, birch or maple.

Machinery for Sale.—One Cataract Tool Company lathe with slide rests, chasing attachment, milling attachment, counter attachment and chuck; one turret head lathe; five special speed lathes for light brass work. All in first-class condition, nearly new. Address The Vogt Optical Company, Rochester, N. Y.

Inquiry No. 320.—For manufacturers of machinery for making hair felt.

Manufacturing agents to sell the Reagan Improved Shaking Grate. We will guarantee to evaporate 25 per cent more water than any other grate on the market and do this when evaporating as many pounds of water per pound of coal as you do now. Good men wanted in all parts of the United States. Write for particulars and terms. Reagan Grate Bar Co., 209 North Front Street, Philadelphia, Pa.

Inquiry No. 321.—For manufacturers in the United States of antimony goods such as plugs, seats, cocks, etc.

For Sale.—A fine man'f'g business, articles covered by patent. You will say it is a chance of a lifetime; we have filled export orders to four foreign countries. Answer and we will give you all particulars. Address G, Box 773, N. Y.

Inquiry No. 322.—For manufacturers of novelties for advertising purposes.

Inquiry No. 323.—For manufacturers of fiber conduit.

Inquiry No. 324.—For manufacturers of fire escapes.

Inquiry No. 325.—For a burglar alarm that uses a blank cartridge, and which can be attached to a door or window.

Inquiry No. 326.—For manufacturers of glass marbles or small glass balls, ⅝ or ¾ inch.

Inquiry No. 327.—For machinery used in pickling factory, such as steam kettles, etc.

Inquiry No. 328.—For manufacturers of glass bottles for pickles.

Inquiry No. 329.—For manufacturers of a thermometer with an electrical attachment which rings a bell when the thermometer gets low or high.

Inquiry No. 330.—For manufacturers of light malleable iron castings.

Inquiry No. 331.—For makers of open eye bolts, size, ⅜ iron.

Inquiry No. 332.—For outfits for making rubber stamps.

Inquiry No. 333.—For manufacturers of steel street letter boxes; to be constructed of well finished soft rolled steel 18 gage English standard, and back to be of Bessemer steel 11 gage English standard.

Inquiry No. 334.—For dealers in electric batteries for discharging dynamite.

Inquiry No. 335.—For parties to make wooden tables and easels in quantities.

Inquiry No. 336.—For a glue filter which will clarify glue liquors.

Inquiry No. 337.—For manufacturers of waxing machines for tissue paper.

Inquiry No. 338.—Wanted to buy one portable, galvano cautery battery with conducting cables and electrodes.

Inquiry No. 339.—For manufacturers of augers for boring wooden pump logs and rims for fitting the same.

Inquiry No. 340.—For a manufacturer of a hand drilling diamond drill.

Inquiry No. 341.—For parties to manufacture a vehicle simple in construction, propelled by hand and foot power and run on two wheels, front and back and two side wheels.

Inquiry No. 342.—For manufacturers of dynamos of about 8 volts.

Inquiry No. 343.—For dealers in silk-worm gut for use in fishing tackle.

Inquiry No. 344.—For machines for automatical numbering in printing.

Inquiry No. 345.—For machinery for making feather dusters.

Inquiry No. 346.—For manufacturers of pneumatic coating machines for applying whitewash.

Inquiry No. 347.—For parties willing to manufacture a number board, patented, in some Eastern city.

Inquiry No. 348.—For parties engaged in building theaters.

Inquiry No. 349.—For manufacturers of meteorological instruments.

Inquiry No. 350.—For manufacturers of kilns for burning lime continuously; kilns from which the lime can be taken out without interfering with the burning.

Inquiry No. 351.—For manufacturers of air compressors to lift water out of wells.

Inquiry No. 352.—For fans run by spring or weight, for ceiling or otherwise.

Inquiry No. 353.—For machinery for bending brass and iron tubing.

Inquiry No. 354.—For manufacturers of spring steel.

Inquiry No. 355.—For manufacturers or dealers in small ball-bearing hubs, also spokes and nipples for constructing small wheels, of 16 inches in diameter.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8144) B. B. asks: What power the motor requires, described in December 8 and 15 copies of the SCIENTIFIC AMERICAN? Also, which are the best batteries to use—the bichromate of potash or storage batteries—and how many of each? If storage batteries are the best, what make is the best, and what size? A. One cell of either of these batteries will run the motor. It makes no difference which is used. Any size will answer, and any make. We do not suppose there is any such thing as a best in these cells. It requires 4 or 6 cells for doing work.

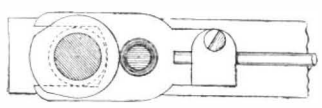
(8145) A. L. L. asks: 1. Can a satisfactorily illuminated picture be produced with acetylene gas light in a moving-picture machine, or can only oxyhydrogen gas (lime light) and electric (arc) light be used? A. The acetylene burners as used in lanterns do not give much above 100 candles, and it is not supposed that a moving picture can be properly illuminated with such a light. 2. Which is the cheaper to use, acetylene or oxyhydrogen gas, when it is made for its own use, and about what will it cost. A. Acetylene is cheaper than the oxyhydrogen light, but there is in it very much less light. Per candle, we presume acetylene is cheaper. Calcium carbide can now be had for a moderate price. We have not the exact figure for the present time. Our advertisers can give them on application.

(8146) C. W. W. asks: Can hilly roads be climbed easier on a high-geared bicycle, say, 80 or 90, than on a low gear, 55 or 60? What is the philosophy of it? A. The hill can be climbed by rider on a low-geared machine easier than on a high-geared machine, because with the low gear he does not have to lift himself so far up the hill with one tread as with the high gear. A 90 gear goes half as far again for one tread as a 60 gear, and therefore requires 1½ times the work for one revolution of the pedal.

(8147) J. W. B. writes: I am trying to make some bar and U magnets, and am having bad luck. What shall I do? A. For permanent magnets use only the best tool steel, Jessop's or Stub's, though fine American tool steel will doubtless give satisfactory results. Harden the ends only glass hard. It is useless to harden the whole length of the bar. Wind a coil into which the bar will slip easily of any convenient size of wire, and with perhaps 100 turns, the number is not important. There should be enough that the coil will not heat badly when in circuit. Put the coil in circuit with your dynamo of lowest voltage, and while the current is flowing push the bar to be magnetized to and fro from end to end of the bar in the coil, stopping at the middle at last. Open the circuit and remove the bar, which should be strongly magnetized.

(8148) R. R. W. asks: 1. In an isolated district would it be feasible to run a 1 or 2 horse power dynamo for private house and barn lighting, by means of a windmill? Could storage batteries be used without great expense when the wind would not blow—the dynamo to be used for charging? A. Very good results have been obtained in operating an electric-lighting plant from a windmill and storage battery in country districts. It must not be expected that the light will be obtained at less expense than oil. 2. Immediately above the photosphere of the sun lies a layer of gases having a spectrum. What name do astronomers give to the spectrum? A. The layer is the reversing layer of the sun. It is composed of the vapors of metals, and the spectrum of a vapor is a line or discontinuous spectrum. Such a spectrum is given by sodium, for example. It consists of two yellow lines. 3. In what year was the first patent for a bevel gear to a bicycle granted? What book could I look up to learn the particulars? A. We cannot state the year. No one can claim the use of bevel gear on bicycles uncombined with any other feature.

(8149) A. S. writes: Please give the dimensions of the face of the cam, with a diagram, if possible, of the simple engine described in the issue of the SCIENTIFIC AMERICAN of November 17, 1900. A. The annexed cut shows the cam roller and fork full size.



(8150) W. H. B. asks: Is it necessary, in order to make a spark that the two glass plates of a Wimshurst machine should revolve at the same speed? A. It is not necessary that the plates of a Wimshurst machine should revolve at the same speed, though it is usually simpler to have them do so.

(8151) B. T. M. asks: Which is the heavier, dry air or an equal volume of moist air, each under the same pressure and at the same temperature? A. Moist air is lighter than dry air at the same temperature and pressure. Water vapor is only about ⅝ as heavy as air.

(8152) R. P. W. writes: A curious explosion occurred February 15 at the house of Mr. Rufus P. Williams, Cambridge, Mass. A new, quart, beer bottle was nearly filled with water which had been run through a Pasteur filter. It was tightly closed by the usual beer-bottle device, and at first put into the cellar, subsequently being placed on a marble wash-stand in a room at, say, 70 deg. F.—about the temperature at which it was filled. After standing some three or four hours, it suddenly exploded, landing the base and neck of the bottle a foot away in the wash bowl. The glass was about 0.5 centimeter in thickness. A. The breaking of the bottle must have been caused by the straining of the glass from some cause in the making of the bottle. It was not an explosion in the ordinary sense of the term. The parts did not fly far enough to be propelled by expanding gas. The force of the cracking glass threw the parts a foot or so. The case of the ink bottle recently published in our columns is similar to this.

TO INVENTORS.

An experience of over fifty years, and the preparation of more than one hundred thousand applications for patents, at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office Scientific American, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

MARCH 26, 1901,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abdominal bandage, E. A. Richmond	670,814
Adjustable wrench, J. C. Burgess	670,890
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Air-ship, O. Olsen	670,807
Alarm, C. H. Bryan	670,702

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Ammunition hoist, R. Matthews 670,717
Andiron, J. D. Cox 670,471
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Automatic operating switch, G. W. Specht .. 670,907
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Boat hoisting or lowering device, S. Bergstein 670,659
Boat lowering device, Allen & Danforth 670,831
Boiler furnace, marine, J. O. Morris 670,719
Book mark, M. G. Carleton 670,766
Bottle capping machine, H. G. Davis 670,768
Brake shoe, J. P. McIntyre 670,639
Bran duster and grain scourer, G. R. Davidson 670,851
Bridge, W. F. Walker 670,570
Broom, antiseptic, O. S. Kulman 670,713
Brush and dentifrice bracket, C. A. Kirkwood 670,481
Buckle, E. W. Groeschel 670,493
Burnishing machine, J. B. Carolin 670,703
Cabinet, W. Downie 670,558
Calcining kettle agitator, W. T. Powers 670,597
Calcium carbid, treating, Borch & Hvild ... 670,607
Comera timing attachment, B. Hernhuter .. 670,635
Can. See Oil can. Sheet metal can.
Can capping machine, Bergland & Teigen .. 670,835
Canceling and postmarking machine, stamp, J. L. Lister 670,619
Candle holder, J. Thomas 670,625
Car door, hopper bottom, G. I. King 670,615
Car draft rigging, railway, G. P. Ritter .. 670,734
Car, hopper bottom, G. A. Hancock 670,586
Car, hopper bottom, King & Jessen 670,614
Car, railway, E. H. Blossom 670,529
Car seat ticket holder, F. K. Stephens 670,647
Car ticket holder, railway, G. F. Sanborn ... 670,623
Carpet sweeper, Johnston & Stewart 670,513
Carriage wheel, horseless, J. Caulfield 670,664
Carbureter, R. E. Olds 670,921
Carbureter, W. J. Powers 670,433
Carbureter, C. I. Tenney 670,599
Case or box holding block, Fletcher & Bulkley 670,446
Casein and producing same, waterproof, A. Schmidt 670,689
Casing elevator, J. J. Davin 670,704
Caster, J. P. Henries 670,426
Casting, steel, A. G. Lundin 670,453
Chain grate furnace, F. R. Tibbitts 670,694
Chair. See Dental chair.
Chairs, etc., clutch for adjusting rods for adjustable back, C. H. Clement 670,896
Chart, V. Bowman 670,762
Chimney cowl, Mills & Reese 670,682
Chisel making die, J. Swan 670,742
Chuck, nipple, D. Collins 670,468
Churn, J. H. Cooper 670,469
Cigar bunch rolling machine, S. Wulkan et al 670,574
Cigar protector, W. G. B. Tyrrell 670,462
Clamp making machine, F. P. Cady 670,891
Clasp. See Lacing clasp.
Cleaning or polishing machine, C. F. & C. H. J. Dilg 670,856
Clock, electric, F. L. Gregory 670,634
Coal loading apparatus, J. L. Lamb (reissue) 11,898
Coaster and brake, J. G. Ziegler 670,575
Cock, ball, J. M. Smith 670,818
Comb, N. O. Emery 670,894
Commutator, G. W. Nistle 670,454
Compass, ship's, W. J. Reynolds 670,733
Composition, J. Kelsey 670,919
Compound engine, S. M. Vauclain 670,745
Concentration, process of, Sutton & Steele .. 670,441
Copied effects, apparatus for producing press, B. S. Creamer 670,472
Corn, machine for hulling green, J. Ritty .. 670,687
Cotton chopper, J. P. Caldwell 670,554
Cream whipper, A. S. Benedict 670,834
Cultivator, A. Lindgren 670,885
Cultivator, listed corn, C. C. Keith 670,541
Current machine and apparatus, continuous. M. Deri 670,557
Curtain rod, H. A. Fowler 670,585
Curtain stretcher frame, R. Hoffheins 670,589
Cut out, suspension, J. J. Wood 670,573
Cutter boxing, H. Gauch 670,448
Cutting round or oval blanks, machine for, C. W. Hobbs 670,636
Cycle, motor, G. M. Holley 670,590
Dental chair, E. M. Fredericks 670,773
Dental plate, A. Biber 670,604
Dibber, J. Hall 670,874
Digester for chemical treatment of substances, B. S. Summers 670,485
Display cabinet for spices, etc., A. E. Cobb. 670,555
Ditching machine, J. H. Koebel 670,787
Door check, G. Stubbs 670,821
Door fastener, J. F. H. Deibel 670,854
Door hanger, sliding, A. Newell 670,640
Door holder, P. F. Lehmann 670,791
Door or window screen fastener, J. W. Lyons 670,797
Doors, etc., antirattling device for, D. G. Musselman 670,515
Draft equalizer, W. C. Campbell 670,839
Draft equalizer, A. H. Niesley 670,431
Draft equalizer, H. Spunaugle 670,459
Draft regulator, J. A. Selph 670,739
Drier, cooker, and presser, combination, A. Schmidseder 670,436
Drill, H. Paulson 670,543
Drill socket, J. D. Cox 670,470
Drip pan alarm attachment, Wahl & Keyes. 670,463
Driving mechanism, frictional, A. A. Carson. 670,535
Eaves trough hanger, C. A. Karpenstein. 670,675, 670,676
Electric accumulators, apparatus for forming elements for, W. Gardiner 670,774
Electric battery, primary, J. P. Fontaine .. 670,583
Electric heater, W. S. Hadaway, Jr 670,667
Electric light handle and adjuster, E. E. Brown 670,552
Electric light shield and reflector, Clark & Ernst 670,536
Electric waves, coherer for detecting, A. Koepsel 670,711
Electrical connecting device, J. S. Schenck. 670,547
Electrical distribution, J. B. Entz 670,476
Electrical heating resistance and making same, W. S. Hadaway, Jr 670,671
Electrically operated brake, G. D. Burton ... 670,415
Elevator, H. Bolander 670,466
Elevator safety device, V. H. Yarnall 670,830
End gate, J. C. Butler 670,532
Engine, R. D. Watson 670,867
Engines, sparking igniter for internal combustion, C. H. Blomstrom 670,914
Envelop, Keller & Titsworth 670,882
Exercising machine, E. R. Ernst 670,706
Expanding clamp, J. Marquardt 670,922
Eyeglasses, H. F. Wallace 670,652
Fabric. See Knitted fabric.
Fan, hydraulic, J. F. Behny 670,759
Farm or yard gate, H. W. Thompson 670,650
Fastener, Applebon & Sibenbitel 670,655
Fastening devices for gloves, etc., manufacture of, W. B. Murphy 670,721
Fastening, fixture, J. Kroder 670,789
Feeder, boiler, J. N. Rice 670,813
Feeder, calf, M. L. Swope 670,823
Feeding device, W. H. Baush 670,910
Fence, water, Walton & Ball 670,464
Fence wire tightener, P. Boger 670,661
Fiber roping and curling machine, S. A. Flower 670,540
Fire escape, hydraulic telescopic, W. H. Sliger 670,548
Fireproof construction, F. W. Garrettson ... 670,478
Fireproof door or shutter, I. W. Emerson .. 670,858
Fireproof partition, J. C. Perry 670,809
Fluid pressure engine, E. A. Stark 670,439
Folding box, J. Clarke 670,840
Folding box, F. H. Houghland 670,612
Fork for handling sheaves, L. C. Sturman .. 670,822
Fruit brusher, H. B. Ruggles 670,457
Fruit gatherer, W. H. Spencer 670,568
Fruit packing device, C. W. Arrasmith 670,525
Funnel, D. S. Horton 670,512
Furnace front, J. B. Houston 670,781
Gage, Traut & Gerry 670,627
Game device, I. M. Van Wagner 670,487
Garbage burner, domestic, E. S. Nowlah 670,806
Garment stretcher, W. H. Shindler 670,817
Gas engine, T. McMahon 670,803
Gas engine, duplex, W. O. Worth 670,550
Gas generator, acetylene, J. S. McGinn 670,542
Gas generator, acetylene, W. G. Ross 670,815
Gas generator, acetylene, J. H. Willers 670,696
Gas machine, acetylene, W. J. Baulieu 670,657
Gas, preparing materials for purifying, J. P. Ihart 670,450
Gas, preparing materials for purifying illuminating, J. P. Ihart 670,451
Gate, J. McKee 670,722
Generator, F. Windhausen, Jr 670,829
Glass moulding machine, F. & A. Shuman .. 670,438
Glass pressing apparatus, W. Buttler 670,764
Glazier's point, J. O. Thilow 670,649
Go-cart, A. E. Howlett 670,918
Golf club, E. F. Thompson 670,522
Grain elevator, fireproof, J. L. Record 670,456
Grain elevators, adjustable spout and cover for, L. E. Jordan 670,881
Grain heater, M. W. Hunt 670,638
Graphophone record duplicating machine, C. S. Tainter 670,442
Grease cup, J. Power 670,516
Grinding machine, O. S. Walker 670,523
Grinding or polishing disk, D. J. Murnane .. 670,593
Gun, air, F. F. Bennett 670,760
Gun mount, F. Sachs 670,906
Guns, trunnion and jacket for rapid fire or machine, F. Sachs 670,735
Gyratory machine supporting apparatus, J. Warrington 670,653
Hair structure, H. Dorenwend 670,857
Hand, artificial, A. C. Mueller 670,684
Hand rake, W. Cronk 670,417
Handle. See Lever handle. Trunk handle.
Harness attachment for poles and shafts, W. F. Schatz 670,435
Harp, S. Raffael 670,732
Harrow, J. B. Gebhardt 670,709
Harrow, disk, R. L. Wight 670,524
Harvester attachment, O. Nygren 670,455
Harvester reel, C. Bransgrove 670,662
Hat and coat hanger, F. Marek, Jr 670,680
Hat fastener, E. T. Miller 670,482
Hat fastener, F. Staufenberger 670,501
Hay press, R. D. Emmonds 670,421
Hay press, J. W. Trout 670,461
Heating apparatus, S. Schwarzschild 670,437
Heating apparatus, steam, J. A. Donnelly ... 670,893
Hinging machine, box, D. H. Saunders 670,816
Hook and eye, T. J. Browning 670,701
Hop drier and curer, J. K. Mount 670,620
Hopper discharge device, Waechter & Hetzel 670,747
Horseshoe nail points, machine for forging, Pierce & Newton 670,622
Horseshoing apparatus, G. N. Barcus 670,603
Hub, vehicle, Kelly & Keena 670,480
Hydrocarbon heater, A. Filigrove 670,769
Hydrometer and syringe, combined, T. D. Bunce 670,663
Ice machine valve, W. J. Francke 670,770
Ice planer, H. Bodenstein 670,698
Incubator, D. C. Coble 670,490
Indexing machine, L. B. Thomas 670,744
Indicator, J. J. McTighe 670,903
Ironing machine, E. G. Smith 670,567
Irrigation, pump battery system for rice, E. M. Ivens 670,784
Kiln for burning or calcining limestone, W. Spencer 670,820
Kitchen table, G. C. Conklin 670,845
Knitted fabric and producing same, W. H. Jackson 670,880
Knitting machine attachment, automatic circular, Black & Dodd 670,489
Knitting machine, circular, H. Clarke 670,892
Knitting machine, circular, L. N. D. Williams 670,828
Knitting machine needle, E. E. Newton 670,886
Lacing clasp, shoe, E. B. Hoegemann 670,561
Lacing, shoe, I. Daniels 670,631
Lamp burner attachment, G. H. Rose 670,517
Lamp, electric arc, E. A. Beck 670,658
Lamp, gasolene, G. Ruppel 670,484
Lamp, hydrocarbon incandescent, P. B. Curran 670,630
Lamp shade or reflector, R. W. Pittman 670,905
Lamp supporting bracket, R. W. Pittman ... 670,904
Lantern, P. C. Bemis 670,913
Last, L. Lanois 670,452
Latch, H. H. Dent 670,506
Lathe feed attachment, E. H. Mack 670,430
Lathe tool post, R. M. Russell 670,546
Lathe, turret, D. B. Bullard 670,837, 670,838
Legging, J. Pullman 670,731
Lens cutting and edging machine, Morgan & Brown 670,500
Letter box, W. L. Vestal 670,825
Lever handle, lock, I. A. Weaver 670,571
Liquid separator, centrifugal, O. J. R. Strom 670,569
Lock key holder, T. S. Thorn 670,626
Loom picker stick lug strap, G. A. Lyon 670,429
Lubricants, making, M. S. Hudnall 670,783
Machinery legs, securer for, M. Brodeur 670,763
Mail bag catcher, Sorensen & Alden 670,693
Mail box, collection and delivery, J. P. Brown 670,553
Mail box, rural delivery, C. Pfeiffer 670,686
Mandrel and chuck, expanding, A. A. A. Byrd 670,533
Marker, land, F. M. Engle 670,705
Mashing and brewing apparatus, L. Prochazka 670,730
Mashing grain, F. Stitzel 670,520
Massage apparatus, J. A. Riviere 670,688
Match making machine, C. R. Bannihr 670,656
Meat chopper, H. K. Wood 670,572
Metal and wood working machine, combination, G. W. Hoadley 670,672
Metal expanding machine, L. E. Curtis 670,606
Metal plates, machine for upsetting edges of, G. J. Hoskins 670,498
Metal sheets or plates, clamp for bundling corrugated, F. G. Caldwell 670,765
Metal structure, expanded, C. B. White 670,827
Moistening, closing, and applying stamps to envelops, machine for, W. S. Post 670,729
Molding apparatus, J. C. Reed 670,641
Molding frame or box, L. Tillet 670,695
Monkey wrench, F. X. Miller 670,799
Motion converting mechanism, M. L. Knapp 670,884
Mower and roller, combination power lawn, W. P. Simpson 670,458
Musical instruments, pneumatic or bellows for, T. P. Brown 670,700
Needle, belt lacing, N. M. Cripe 670,445
Needle holder, W. W. Crowe 670,665
Nest protector, hen's, C. F. Auer 670,832
Oil burner for heating purposes, C. Blumer .. 670,660
Oil can, W. H. H. Erwin 670,509
Ordnance sighting apparatus, A. A. Common 670,579
Ore concentrator, electric, Sutton & Steele .. 670,440
Organ, portable, P. P. Bilhorn 670,551
Oven, baking, A. J. Baxley 670,911
Packing, piston rod, E. Reynolds 670,565
Pad. See Blotting pad.
Pail support, milk, W. C. Adams 670,628
Paint compound and making, G. R. King 670,678
Paper bag, A. Diem 670,507
Paper box, E. M. Scott 670,690
Paper coating machine, C. F. W. Schumacher 670,518
Paper cutters, combined auxiliary gage and clamp for, H. F. Hammond 670,876
Paper folding and stapling machine, R. C. Seymour 670,624
Paper holder, H. Hornbostel 670,562
Paper, manufacture of, Friese-Greene & Knell 670,511
Paper wrappers for bottles, machine for making, E. Bowen 670,761
Pattern, drag, J. G. Johnston 670,613
Pegging machine anvil, I. Frechette 670,771
Pegging machine presser foot, I. Frechette 670,772
Pen, J. E. O. Dahlberg 670,849
Photographic roll holder, W. N. Moore 670,683
Photographic shutter, N. A. Cobb .. 670,843, 670,844
Photomicrographic plate holder, N. A. Cobb 670,842
Pianoforte, C. R. S. J. Halle 670,875
Picture, H. H. Vinton 670,826
Picture hanger, I. H. Solomon 670,692
Pipe and nut wrench, adjustable, H. J. Martin 670,681
Pipe and pipe coupling, A. Fowle, Jr 670,584
Pipe hanger, J. R. Drozeski 670,870
Pipes and protecting covers made of plastic materials, mouthpiece for presses for the manufacture of, C. Hoffmann 670,611
Plauter, corn, T. Knapp 670,616
Planter, corn, Olsen & Evanson 670,685
Planter, cotton, R. A. Brown 670,467
Planter, pea, E. W. Hubbard 670,879
Plow, J. A. Lee 670,514
Plow, C. E. A. Swebilius 670,743
Plowshare fastener, Shock & Russell 670,566
Pneumatic tool, W. H. Soley 670,645, 670,646
Poke, animal, C. H. McBroom 670,800
Poultry decapitating device, P. J. Higgins .. 670,479
Power transmitting apparatus, J. N. & L. D. Fulton 670,447
Power transmitting device, F. S. Weatherly 670,908
Press. See Baling press. Hay press.
Pressure regulator, J. B. Erwin 670,539
Primary battery and regenerating same, H. K. Hess 670,877
Printing and product thereof, W. Friese-Greene 670,510
Printing, changeable form for, L. K. Mearkle 670,718
Printing press attachment for printing from inked ribbons, C. E. Adamson 670,576
Profile instruments, W. M. McCartney 670,594
Projectile, firearm, H. E. Pool 670,728
Protractor, draftsman's, D. J. Kelsey 670,677
Pruning shears, W. Cronk 670,416
Pump, P. J. Bode 670,868
Pump, double acting, W. R. Lynch 670,796
Pump, portable air, J. C. Phelps 670,811
Pump, power force, P. A. Myers 670,902
Quilting frame, H. Glacken 670,872
Rack generating machine, E. R. Fellows 670,859
Rails, etc., apparatus for increasing the cross sectional area of metal, G. S. Merrill 670,592
Rails, etc., increasing the cross sectional area of metal, G. S. Merrill 670,591
Railway brake, A. Duppler 670,419, 670,420
Railway brake, A. Green 670,873
Railway, electric, W. T. Van Dorn 670,651
Railway signaling apparatus, P. C. Bemis. 670,912
Railway tie and chair, metallic, R. R. Allshouse 670,754
Railway tie, composite, C. C. Harrell 670,495
Railways, switch mechanism for surface contact, Hanchett & Murphy 670,425
Railways, unit-multiple system of electric, F. C. Esmond 670,896
Range gas attachment, F. L. Sheppard 670,740
Ratchet drill, A. Kerry 670,710
Reach coupling, L. T. Rector 670,434
Refrigeration system, C. W. Coleman 670,915
Revolver cylinder latch, O. F. Mossberg 670,862
Rock-drill, W. Wood 670,750
Rocker arm, A. Cowperthwait 670,556
Rolling apparatus, sheet-metal, B. E. V. Luty 670,920
Rolling mill guide, T. V. Allis 670,654
Rolling pin, C. B. Henderson 670,779
Roofing, connecting corrugated metal sheets for, F. A. Abeleven 670,753
Roofs weatherproof, means for rendering grooved tile, G. A. Neberling 670,723
Rotary engine, compound, I. M. House 670,637
Sadiron, Hoyt & Minturn 670,499
Sash balance, R. A. MacKenzie 670,679
Scoring device, F. P. Gorin 670,610
Seaming machine, double, W. F. Davis 670,632
Seeding machine and fertilizer distributer, O. L. Carmical 670,534
Shade adjuster, window, H. M. Sturgis 670,460
Shade roller, E. F. Hartshorn 670,587
Shafting flexible, P. Weddeler 670,748
Sheave, J. R. Ball 670,756
Sheet metal can, J. C. Lewis 670,618
Sheet metal can, J. M. Mungiven 670,720
Sheet metal edging machine, A. Danzer 670,504
Shingle machine, D. F. Baker 670,602
Ship's course recorder, J. Hope 670,861
Shutter bower, J. Hoopes 670,780
Signal device, rural, F. C. Bates 670,833
Silk finishing machine, J. White 670,749
Sink, J. A. Duffy 670,418
Sled propeller, A. M. Banks 670,526
Smoke distributer, M. B. Cope 670,580
Soda fountain, F. H. Lippincott 670,792, 670,793
Solar generator, A. G. Eneas 670,916, 670,917
Speed indicator, R. N. Powers 670,432
Spoon holder, B. Anderson 670,502
Spring seat, J. F. Pope 670,483
Stacker and derrick, hay, M. C. Hutchings. 670,674
Stamp mill attachment, L. R. Tulloch 670,549
Starting gate, T. Barnett 670,578
Steam engine, J. W. Powers 670,863
Steam engine for air compressors, G. B. Petsche 670,810
Steam trap, B. F. Allen 670,909
Stereoscope, J. S. Wyatt 670,752
Stokers, driving mechanism for mechanical, H. R. Nelson 670,804
Stone sawing machine hanger, G. D. Hunter 670,673
Stopper. See Tube stopper.
Storage battery, J. B. Entz 670,474, 670,475
Stove, electric, W. S. Hadaway, Jr .. 670,669, 670,670
Stove, gas, E. J. Daschbach 670,850
Stove, heating, J. Simpson 670,741
Stove, hot blast, J. Kennedy 670,883
Straw discharger and shredder, M. A. Flautt 670,860
Street and station indicator, F. Schubert 670,644
Stuffing box, oscillating, D. W. Kenney 670,900
Sulfuric anhydrid, apparatus for making, W. Hasenbach 670,559
Tacking tool, hand, A. Hebert 670,496
Tank and means for discharging contents thereof, C. Erisman 670,581, 670,582
Tap, expanding, G. H. Burley 670,531
Tay wrench, W. E. Horsfield 670,899
Telegraphy, system of, F. Bedell 670,697
Telephone circuit, subscriber's, W. W. Dean. 670,538
Telephone receiver, C. H. North 670,564
Tentering or stretching machine cloth holder, E. A. Rusden 670,598
Thill coupling, T. J. Gibbons 670,491
Threshing concave and tooth, G. S. Lowell .. 670,714
Tile setting, W. v. Baumbach 670,465
Tiles, etc., kiln for glazing, R. Guastavino .. 670,777
Tire, pneumatic, P. W. Tillinghast 670,866
Tire, vehicle, J. Pfeiffer 670,544
Titanium compound and making same, H. Spence 670,819
Tobacco, combined stamping and tagging machine for plug, F. A. Bonroe 670,836
Tobacco curing case, A. L. Fisher 670,423
Tobacco leaf booking block, N. Du Brul 670,508
Toy, automatic diving, S. G. Poli 670,727
Toy cannon, rapid fire, C. T. Bonn 670,629
Train control, unit multiple system of, F. C. Esmond 670,897, 670,898
Train control, unit multiple system of electrical, F. C. Esmond 670,895
Trolley device, safety, C. W. Diamond 670,855
Trolley wheel, R. Kuhn 670,712
Trunk handle, W. B. Gould 670,492
Truss support, hernial, W. F. Brownell 670,530
Tube stopper, E. Blamey 670,528
Tunnels for sewers, etc., construction for, O. Guthrie 670,778
Typewriting machine, C. A. Bennett 670,889
Typewriting machine, B. A. Brooks 670,699
Typewriting machine, Fox & Barrett 670,477
Typewriting machine keyboard cover, C. P. Seippel 670,691
Typewriting machine ribbon mechanism, H. L. & F. L. Wagner 670,600
Valve, J. B. Lott 670,794
Valve, H. A. Wood 670,601
Valve and air brake mechanism, automatic equalizing check, W. S. Morris 670,563
Valve balancing device, engine, L. D. Lovekin 670,795
Valve, cut off, F. H. Bates 670,758
Valve, engine, T. Winship 670,444
Valve for inflating bodies, E. F. Pickett 670,725
Valve gear, explosive engine, A. J. Frith ... 670,871
Valve, self flushing time, G. E. Ridgway ... 670,888
Valve, throttle, Schmidbauer & Ernst 670,737
Vapor burner, incandescent, L. S. Pfouts ... 670,887
Vehicle brake, O. Heylmann 670,560
Vehicle, motor road, J. Vollmer 670,746
Vehicle running gear, M. Payne 670,724
Vehicle wheel, L. E. Thompson 670,824
Vehicles by electricity, means for propulsion of, Newman & Ledwinka (reissue). 11,899
Velocipede, E. G. Latta 670,617
Velocipede crank axle, J. P. Scovill 670,519
Vending machine, coin controlled, Roney & Harrison 670,864
Ventilating apparatus, W. E. Vernon 670,443
Vise, hand, E. H. Kreider 670,788
Voting machine, A. A. Farwell 670,633
Voting machine, G. L. Hoxie 670,427
Voting machine, St. Louis & Barceloux 670,521
Wagon brake, R. F. Armstrong 670,755
Wagon brake, Schmidt & Haas 670,738
Wagon brake, automatic, T. Howle 670,782
Wagon, dumping, J. F. Chevalier 670,605
Wall construction, Fisher & Brouse 670,707
Warp machine, circular, H. Hill 670,497
Washer machine, J. C. Davis 670,852
Water bag, Hogan & Meinecke 670,878
Water closet, siphon, W. E. Hinsdale 670,588
Water cooling device, L. L. Summers 670,486
Water elevating wheel, H. H. McAdams 670,621
Water heater, portable, A. Redfern 670,812
Water trough, stock, J. J. McCourt 670,802
Wave and tide motor, E. P. Couture 670,537
Weather strip, F. P. McCammon 670,801
Welding, electric, J. C. Perry 670,808
Wells, removing paraffin from oil, G. L. Ball 670,577
Windmill, R. A. Nicholl 670,805
Window, C. H. Willits 670,488
Window bead fastener, T. O'Shea 670,595
Window frame and sash guide, G. O. Smith. 670,865
Wire drawing machine, B. Granville 670,424
Wire weaving machine, E. C. Mathews 670,716
Wood and making same, imitation, W. N. Cornell 670,847
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Wool cleaning machine, F. G. Sargent 670,643
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Binding, skirt, C. Seidel ..... 34,295 to 24,298
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Brick or tile, B. Jacquart 34,284, 34,285
Buckle, C. Knothe 34,266
Buckle member, belt, A. Holmes 34,265
Buckle tongue, belt, A. Holmes 34,264
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Clasp for package fasteners, F. Bailey 34,263
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Fabric, D. J. Seaman ..... 34,301 to 34,303
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Head rest, C. F. Davidson 34,288
Hub flange, C. Minshall 34,289, 34,290
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Latch, gate, G. B. Howland 34,279
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Medical compounds, certain named, W. D. Duncan 36,131
Medicinal preparations, certain named, J. W. Wright 36,132
Medicine, certain named, W. R. Warner 36,133
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Preserved or canned goods, F. Wolferman 36,119
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"Rubberine," for cloths, J. Milloy & Co 8,246
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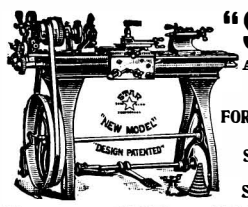

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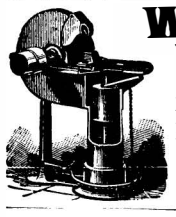

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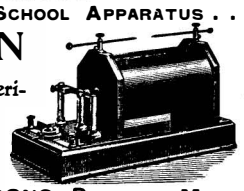

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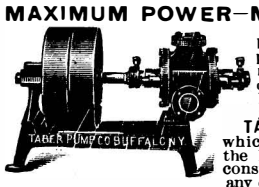

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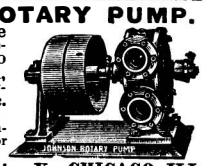

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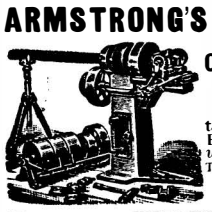

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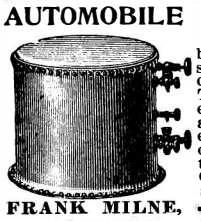

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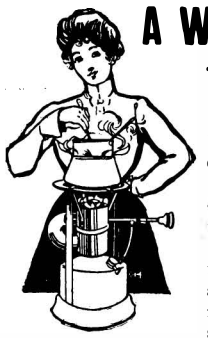

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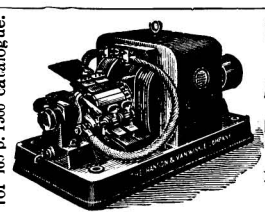

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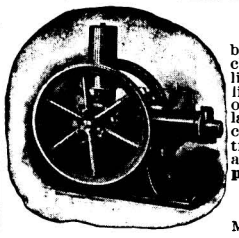

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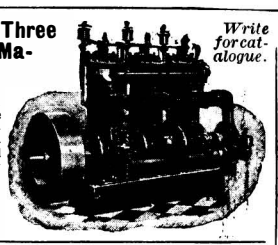

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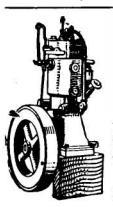

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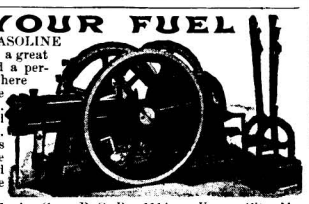

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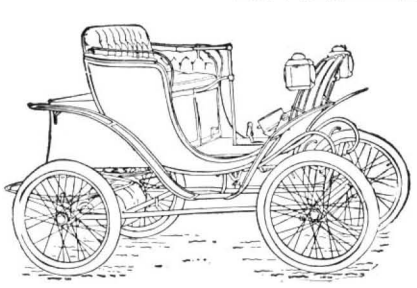

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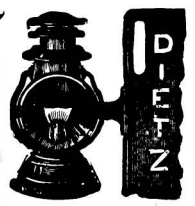

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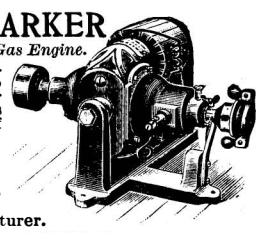

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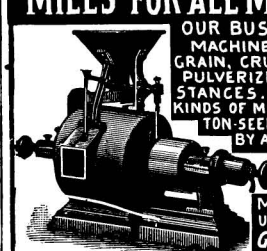

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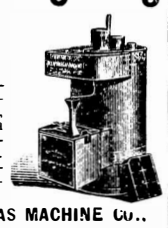

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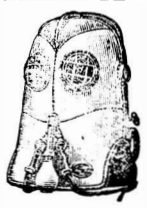

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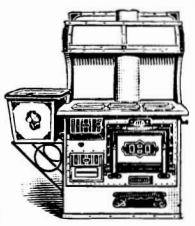

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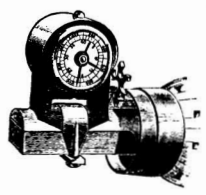

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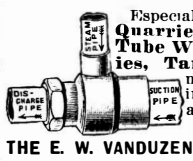

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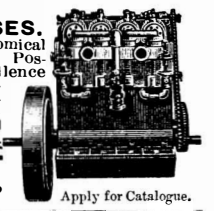

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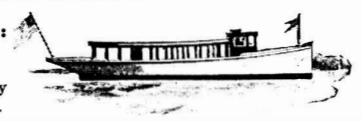

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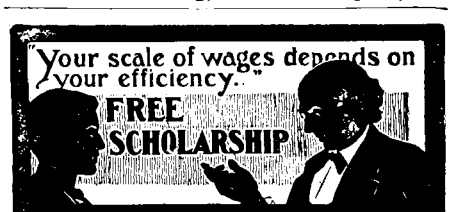

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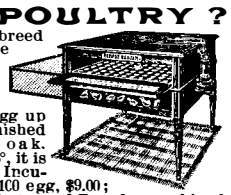

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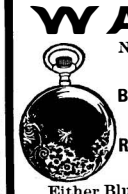

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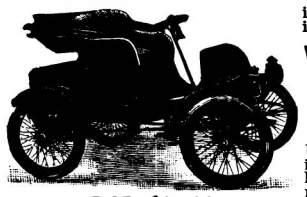

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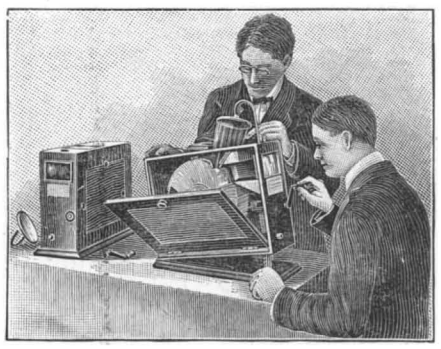

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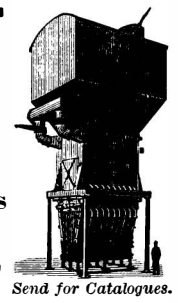

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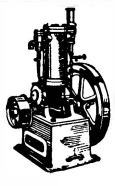

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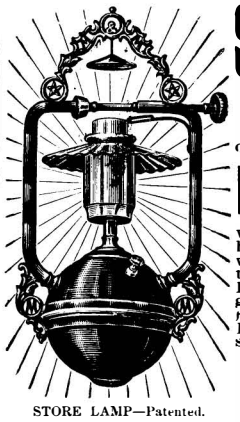

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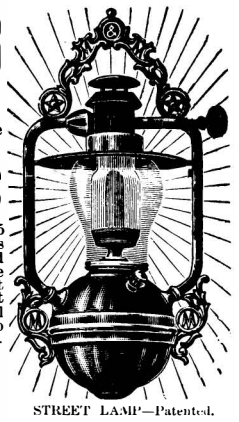

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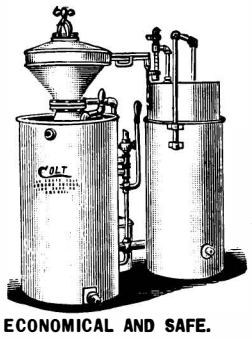

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